



Workshop Manual

Fox 2004 ➤
SpaceFox 2006 ➤
SpaceFox 2011 ➤

4 - Cyl. diesel engine

Engine ID	ASY								
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Edition 04.2013

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List of Workshop Manual Repair Groups

Repair Group

- 00 - Technical data
- 10 - Removing and installing engine
- 13 - Crankshaft group
- 15 - Cylinder head, valve gear
- 17 - Lubrication
- 19 - Cooling
- 20 - Fuel supply system
- 23 - Mixture preparation - injection
- 26 - Exhaust system
- 28 - Ignition system

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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Contents

00 - Technical data	1
1 Technical data	1
1.1 Engine number	1
1.2 Engine characteristics	1
10 - Removing and installing engine	2
1 Engine - remove and install	2
1.1 Notes on removal	3
1.2 Engine - fasten to assembly stand	6
1.3 Notes on installation	7
1.4 Tightening torques	8
1.5 Power-drive unit supports	8
1.6 Additional notes and installation works in vehicles with air conditioning	9
13 - Crankshaft group	11
1 Engine - assembly and disassembly	11
1.1 Poly-V belt - remove and install	15
1.2 Toothed belt semi-automatic tensioning pulley - check	17
2 Crankshaft and flywheel seal - remove and install	18
2.1 Crankshaft seal (pulley side) - replace	20
2.2 Crankshaft flanges (flywheel side) - removal and installation	22
3 Crankshaft - remove and install	26
3.1 Crankshaft measurements	27
4 Pistons and connecting rods - removal and installation	28
4.1 Piston protrusion - check	31
4.2 Piston and cylinder dimensions	32
15 - Cylinder head, valve gear	33
1 Cylinder head - assembly and disassembly	33
1.1 Toothed belt - remove and install, adjust	36
1.2 Cylinder head - remove and install	41
1.3 Compression - check	47
2 Valve command - repair	50
2.1 Valve seat - trim	52
2.2 Valve guides - check	54
2.3 Valve rod sealant - replacement	54
2.4 Camshaft - remove and install	56
2.5 Hydraulic tappets - check	59
17 - Lubrication	61
1 Lubrication system components - remove and install	61
1.1 Crankcase - remove and install	65
1.2 Oil pump - remove and install	67
1.3 Oil pressure and Oil pressure switch F1 - check	68
19 - Cooling	71
1 Cooling system components - remove and install	71
1.1 Cooling system components, body	71
1.2 Cooling system components, engine	73
1.3 Cooling hose connection diagram	74
1.4 Cooling system - drain and fill	75
1.5 Water pump - remove and install	78



1.6 Radiator - remove and install	80
1.7 Thermostat valve - removal and installation	82
20 - Fuel supply system	85
1 Fuel supply system components - removal and installation	85
1.1 Fuel tank with accessories - remove and install	85
1.2 Fuel filter - repair	89
1.3 Safety measures when working on supply system	91
1.4 Cleaning rules	91
1.5 Fuel reservoir - remove and install	92
1.6 Fuel level indicator sensor G	93
1.7 Fuel level gauge - remove and install	96
1.8 Engine power electronic adjustment (electronic accelerator): check	97
23 - Mixture preparation - injection	98
1 Diesel direct injection system - repair	98
1.1 Safety measures	98
1.2 Cleaning rules	98
1.3 Injection pump - repair	99
1.4 Intake manifold - remove and install	101
1.5 Injection pump - remove and install	102
1.6 Nozzles - remove and install	106
1.7 Injectors - check	108
1.8 Sealing ring of the cap of injection adjuster - replace	109
2 Control unit of Diesel direct injection system J248	110
2.1 Control unit of Diesel direct injection system J248 - remove and install	110
2.2 Event memory of Control unit of Diesel direct injection system J248 - check and erase	110
2.3 Functions and components - adapt	111
26 - Exhaust system	113
1 Removing and installing exhaust system parts	113
1.1 Exhaust system - remove and install	113
2 Exhaust gas return system	117
2.1 Exhaust gas return system components - removal and installation	117
2.2 Vacuum hose connection diagram	118
2.3 Check the exhaust gas return valve	118
28 - Ignition system	120
1 Preheating system - check	120
1.1 Glow plugs - check	120



00 – Technical data

1 Technical data

(VRL005694; Edition 04.2013)

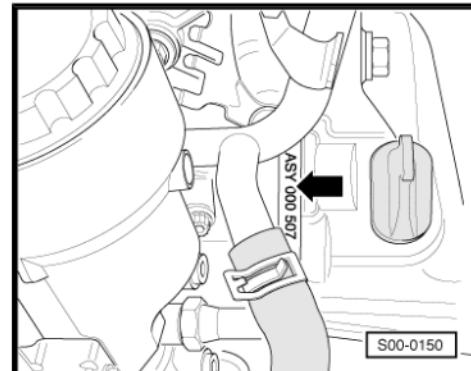
1.1 Engine number

The engine number ("engine code letters" and "serial number") is engraved on the cylinder block, in the area dividing engine/gearbox.

The engine number has a maximum of nine (alphanumeric) digits. The first part (maximum of three identification letters) represents "the engine identification letters"; the second part (six characters) represents the "serial number". If more than 999,999 engines are produced using the same engine codes, the first of the six digits is replaced by a letter.

Furthermore, there is a sticker on the upper cover of the mechanical distribution with "the engine code letters" and "the serial number".

The engine identification letters are also shown on the vehicle data plate.



1.2 Engine characteristics

Engine codes	ASY
Production	11.01 ➤
Cylinder volume	1896
As per exhaust gas limit values	EU 3 Norm
Power	64,0(47,0)/4000
Torque setting	125,0(12,7)/1600...2800
Bore	79,5
Stroke	95,5
Compression rate	19,5:1
CZ	49
Knock control	1 knock sensor
Self-diagnosis	yes
Catalytic converter	yes
Recirculation of exhaust gases	yes

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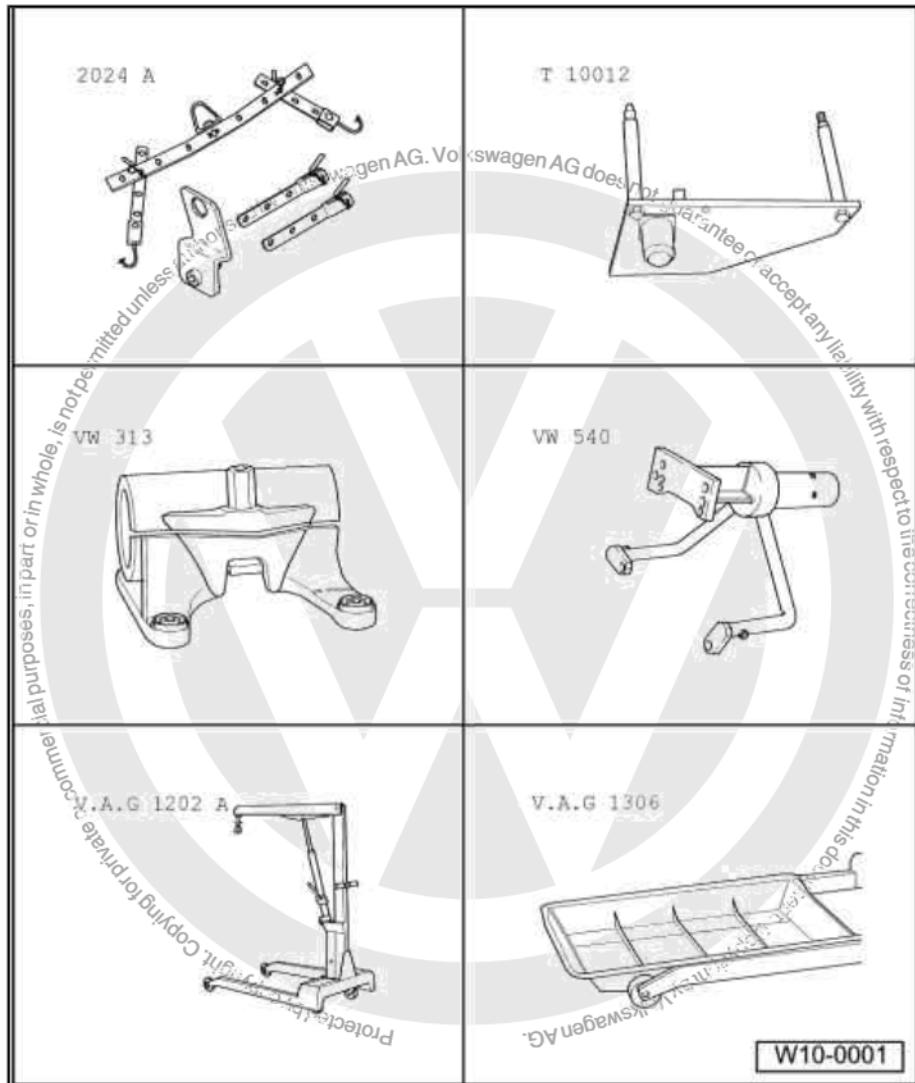


10 – Removing and installing engine

1 Engine - remove and install

Special tools and workshop equipment required

- ◆ Hanger or VW 055 - 2024A-
- ◆ Support - T 10012-
- ◆ Support for VW 643 or VW 643/1 - VW 313- or Rotary stand for engine and gearbox - VAS 6095-
- ◆ Support - VW 540-
- ◆ Hydraulic hoist - V.A.G 1202 A-
- ◆ Oil collecting tray - VAG 1306-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-
- ◆ Torque meter - 40 to 200 Nm (enc. 1/2") - VAG 1332-





- ◆ Gearbox or engine/gearbox set jack - VAG 1383A-
- ◆ Standard-type clamp pliers - VW 5162 (VWB) - ou - VAS 5024A-
- ◆ 5-degree scale - VAS 5085-
- ◆ Grease - G 000 100-
- ◆ Screw M10×25 / 8.8
- ◆ Cable tie
- ◆ Supporting device - 10 - 222A- with feet - 10 - 222A/1-

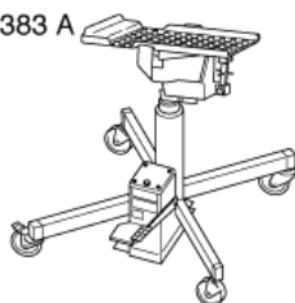
V.A.G 1331



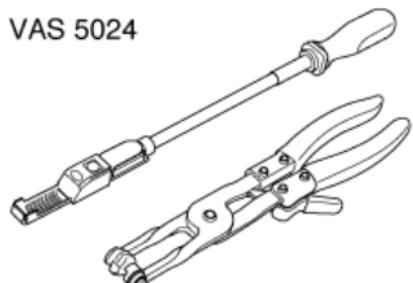
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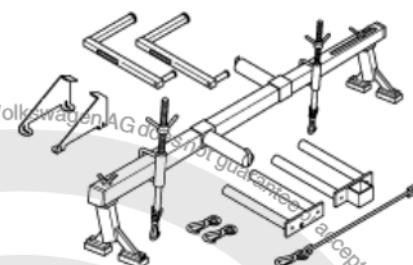
V.A.G 1383 A



VAS 5024



10-222 A



VAS 5085



W10-10008

1.1 Notes on removal

- The engine is removed together with the gearbox from below.



WARNING

Remember the following when performing installation work, especially inside the engine compartment where there is little space:

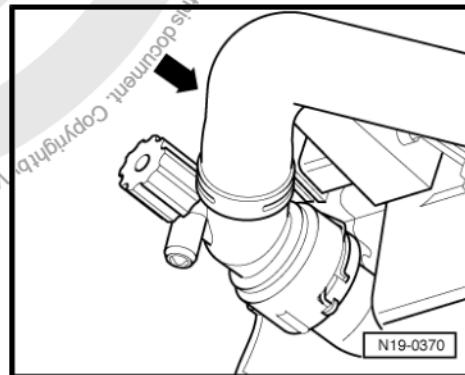
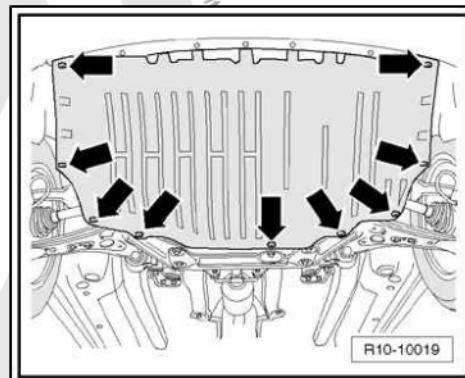
- ◆ All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling system and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.
- ◆ Allow easy access to all the moving or hot parts.
- All the clamps that are open or removed to remove the engine shall during assembly be installed again at the same points.



Note

During the work, the Battery - A- earth strap must be disconnected. First, check if the vehicle is equipped with a coded radio. If so, obtain the anti-theft code prior to beginning work.

- With the ignition turned off, disconnect the earth wire from the battery - A- .
- Open and close coolant tank cover to discharge the pressure in the cooling system.
- Remove Battery - A- and the support of Battery - A- .
- Remove connecting line between air filter and intake manifold.
- Remove air filter.
- Remove the noise insulation from the engine.
- Remove the drive shaft on the right side and loosen the one on the left of the gearbox: ⇒ Chassis, axles, steering; Rep. gr. 40 ; Front suspension .
- Raise the left drive shaft and tie it up to stabilizer.
- Remove the front section of exhaust tube with catalytic converter ⇒ [page 113](#) .
- Drain cooling system ⇒ [page 75](#) .
- Remove engine lines with Standard-type clamp pliers - VW 5162 (VWB) - ou - VAS 5024A- .
- Remove the lower line of the radiator -arrow-.
- Disconnect and loosen all gearbox electric cables, Generator (Alternator) - C- and Starter - B...- .
- Disconnect all connection, cooling, vacuum and engine intake lines.
- Release the clutch hydraulic slave cylinder : ⇒ Automatic/ mechanical transmission; Rep. gr. 30 ; Clutch - control system .
- Release the gearbox selector lever ⇒ Automatic/manual gearbox; Rep. gr. 34 ; Drive, housing .

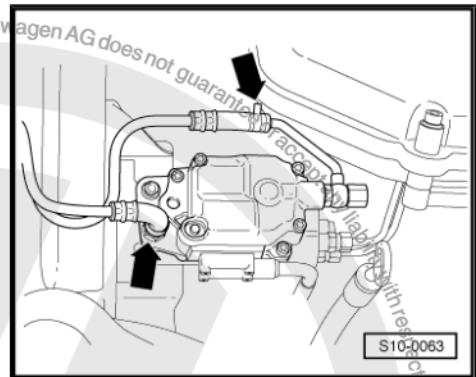


WARNING

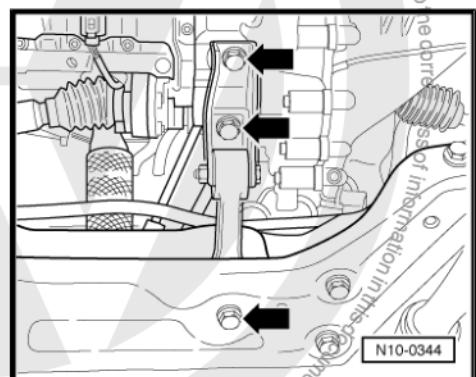
- ◆ The fuel and fuel pipes may become very hot (danger of burning)!
- ◆ Besides, the fuel system is under pressure! Before opening the system, put a cloth over the connection and relief pressure cautiously!
- ◆ Use safety goggles and gloves in all works in the fuel system!



- Disconnect fuel supply and return lines -arrows- in the injection pump.
- Close the lines so as to prevent any dirt from entering the fuel system.
- Follow cleaning rules [⇒ page 91](#).
- Disconnect and loosen the remaining electric connections from engine.



- Remove the pendulum support -arrows-.

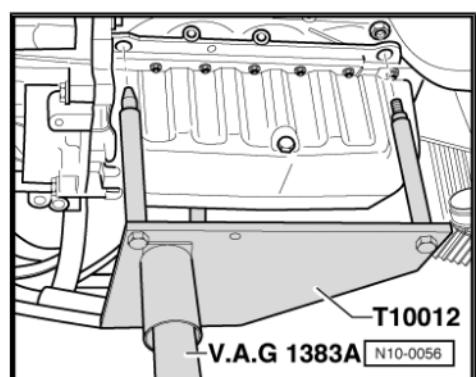


1.1.1 Vehicle with air-conditioning:

- Remove the Poly-V belt [⇒ page 15](#).
- Observe additional instructions and assembly activities [⇒ page 9](#).
- Remove the Generator (Alternator) - C- .

1.1.2 Continuation for all vehicles

- Install the Support - T 10012- on the Gearbox or engine + gearbox set jack or EQ 7081 - VAG 1383A- .
- With fastening nut and securing bolt M10×25/ 8.8, install the Support - T 10012- to engine block with approx. 40 Nm.
- Slightly raise the engine with gearbox using the Gearbox or engine + gearbox set jack - VAG 1383A- .

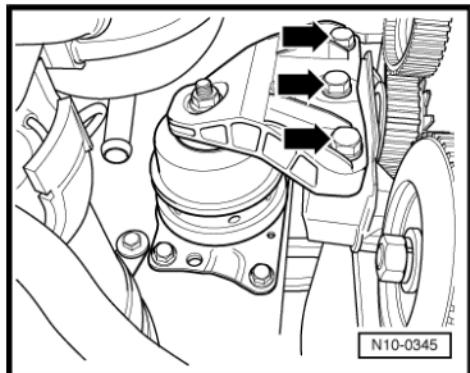




- Release the assembly mounting from above next to the engine support -arrows- .



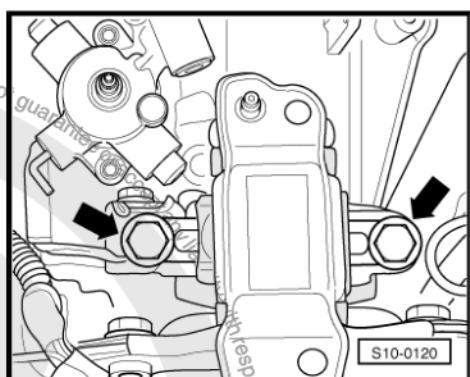
To remove the securing bolts, use the 5-step ladder - VAS 5085- .



- Release the assembly mounting from above next to the gearbox support -arrows- .
- Lower engine carefully with the gearbox.



Lower the engine and gearbox with care to avoid damage to the body.



1.2 Engine - fasten to assembly stand

To perform the assembly works, it is necessary to fasten the engine to the Gearbox or gearbox + engine set jack - VAG 1383A- or Support - VW 540- .

1.2.1 Operation sequence

- Loosen gearbox.



1.2.2 Continuation for all vehicles

- Suspend the Suspender or VW 055 - 2024A- as shown, and remove it from Gearbox or gearbox + engine set jack - VAG 1383A- , with help of the Hydraulic hoist - V.A.G 1202 A- .

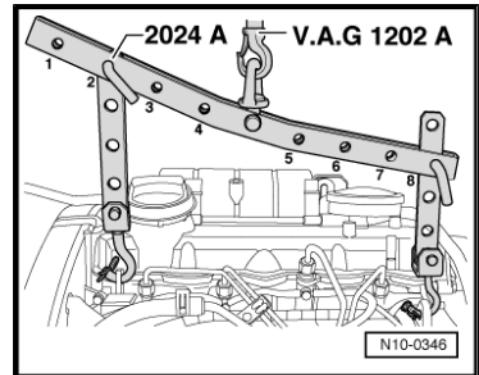
Pulley side: position 4 of the vertical rod. Orifice on the sustaining bar in position 2

Flywheel side: position 3 of the vertical rod. Orifice on the sustaining bar in position 8



WARNING

Use safety locks on the hooks and pins -arrows-.



Note

- ◆ Alignment positions marked from 1...8 in the sustaining rod are directed to the pulley.
- ◆ The holes on the vertical rods are counted beginning from the hook.
- Fasten the engine with the Support for VW 643 or VW 643/1 - VW 313- or Rotary stand for engine and gearbox - VAS 6095- .

1.3 Notes on installation

Install by inverting the removal sequence, paying attention to the following:

- Check clutch bearing for wear, replace if necessary.
- Slightly lubricate the clutch bearing, guide sleeve for clutch bearing, and primary shaft splines with Grease - G 000 100- .
- Check if there are coupling guides for engine/gearbox in the engine block, install if necessary.
- Upon installing the assembly, pay attention to mobility in relation to final drives.



Note

Tightening torque for the assembly mountings [⇒ page 8](#) .

- Align the engine without tension through movement, if necessary, release also the engine support in the body.
- Install gear shifting lever: ⇒ Automatic / manual gearbox; Rep. gr. 34 ; Drive housing .
- Install the clutch hydraulic slave cylinder: ⇒ Automatic / mechanical transmission; Rep. gr. 30 ; Clutch - control system .
- Install cooling and vacuum lines.

1.3.1 Vehicles with air conditioning

- Install the air conditioning compressor: ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .
- Install the Generator (Alternator) - C- .



1.3.2 Continuation for all vehicles

- Install Poly-V belt [⇒ page 15](#) .
- Electric connections and positioning: ⇒ Electrical system;
Rep. gr. 97 ; Wiring harnesses and cables :
- Remove the front section of exhaust tube with catalytic converter [⇒ page 113](#) .
- Replenish cooling system [⇒ page 75](#) .
- Perform test run and check event memory [⇒ page 110](#) .

1.4 Tightening torques

Location		Tightening torque
Screws and nuts	M6	10 Nm
	M7	15 Nm
	M8	25 Nm
	M10	40 Nm
	M12	60 Nm
Bolts connecting engine to gearbox	M10	45 Nm
Bolts connecting engine to gearbox	M12	80 Nm
Drive shafts and flanges		40 Nm
Exhaust tube		40 Nm



Note

Tightening torques for the assembly mounting [⇒ page 8](#) .

1.5 Power-drive unit supports

1.5.1 Tightening torques



WARNING

Before releasing the bolts, the assemblies must be fastened with Support or VW 061 - 10-222A-



WARNING

Always replace self-locking nuts and screws subject to angular torque

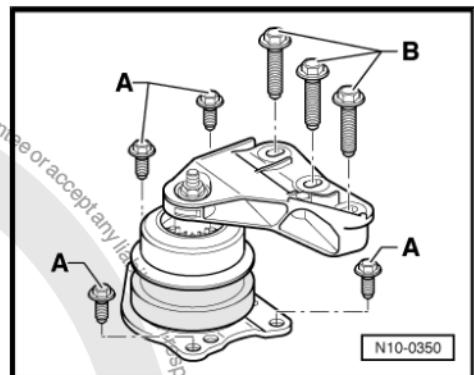


Power-drive group support, engine

A¹⁾ = 20 Nm + 90°

B¹⁾ = 30 Nm + 90°

1) Replace

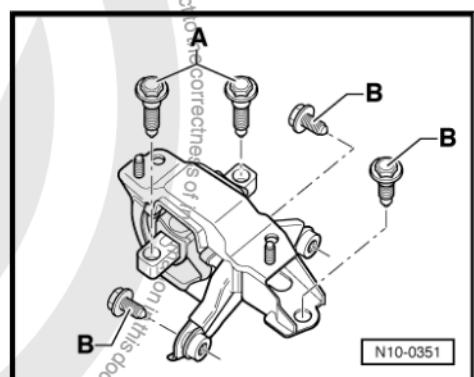


Power-drive group support, transmission

A²⁾ = 40 Nm + 90°

B²⁾ = 50 Nm + 90°

2) Replace.

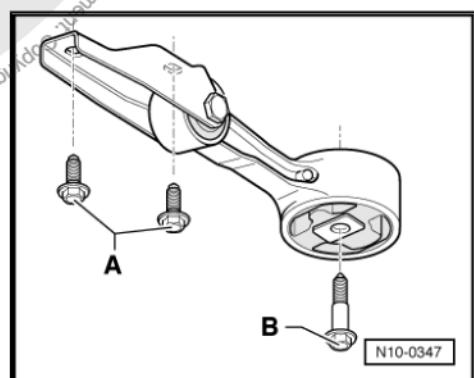


Pendulum support

A³⁾ = 30 Nm + 90°

B³⁾ = 40 Nm + 90°

3) Replace.



1.6 Additional notes and installation works
 in vehicles with air conditioning



WARNING

The cooling gas circuit for the air conditioner should not be opened.



Note

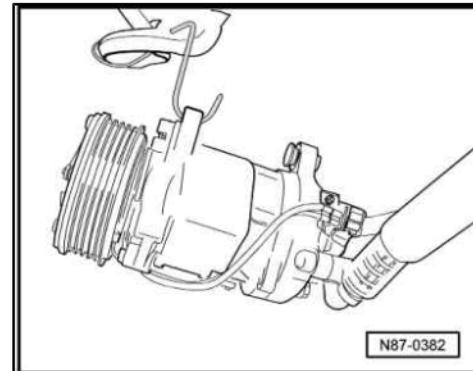
*To prevent damages to the cooling gas lines and condenser,
 make sure the lines are not twisted, bent or excessively stretched.*

To remove and install the engine without opening the refrigerant circuit:

- Remove cooling gas hose clamp(s).
- Remove the Poly-V belt [⇒ page 15](#).



- Remove the Generator (Alternator) - C- .
- Remove the air conditioning compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .
- Fasten the compressor to the body so that the cooling gas tubes/hoses are not subject to tension.



N87-0382





13 – Crankshaft group

1 Engine - assembly and disassembly



Note

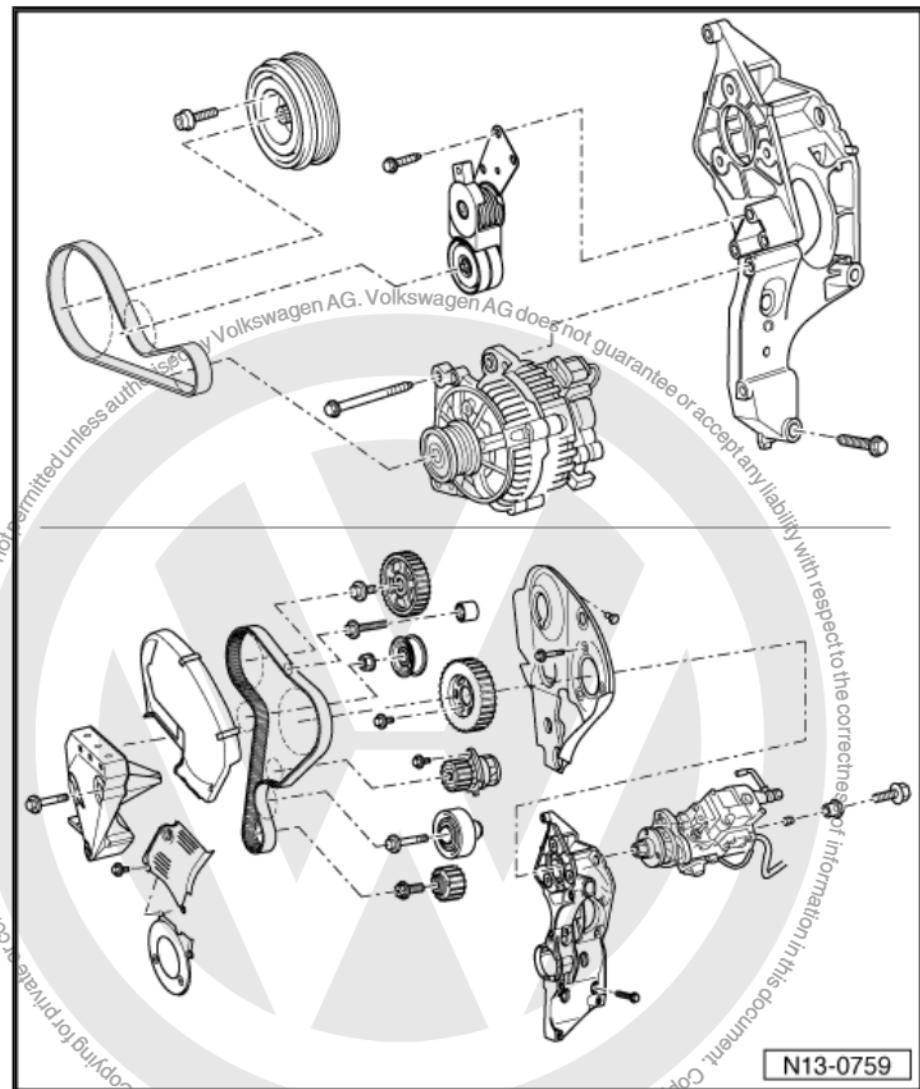
- ◆ *To carry out assembly works, fasten the engine on the assembly stand, using the Support for VW 643 or VW 643/1 - VW 313- or Rotary stand for engine and gearbox - VAS 6095-.*
- ◆ *It is necessary to carefully clean the oil ducts and to replace the oil filter if, when servicing the engine, significant amounts of metal particles and detached particles are found in the oil, due to abrasion or wear resulting from seizing (for instance, from the connecting rods or bearing shells). This procedure prevents any consequential damage.*
- ◆ *Lubricate all supporting and sliding surfaces prior assembly.*



WARNING

Always replace self-locking nuts and screws subject to angular torque





Part I



1 - 10 Nm 90°

- Replace after each removal.

2 - Pulley / vibration damper

- Installation is possible in one only position (displaced holes).

3 - 25 Nm

4 - Tensioning device for Poly-V belts

5 - Compact support

- Upon installation, pay attention to centring of coupling guides.
- Remove the Generator (Alternator) - C- .
- In case of additional accessories with air conditioning compressor.

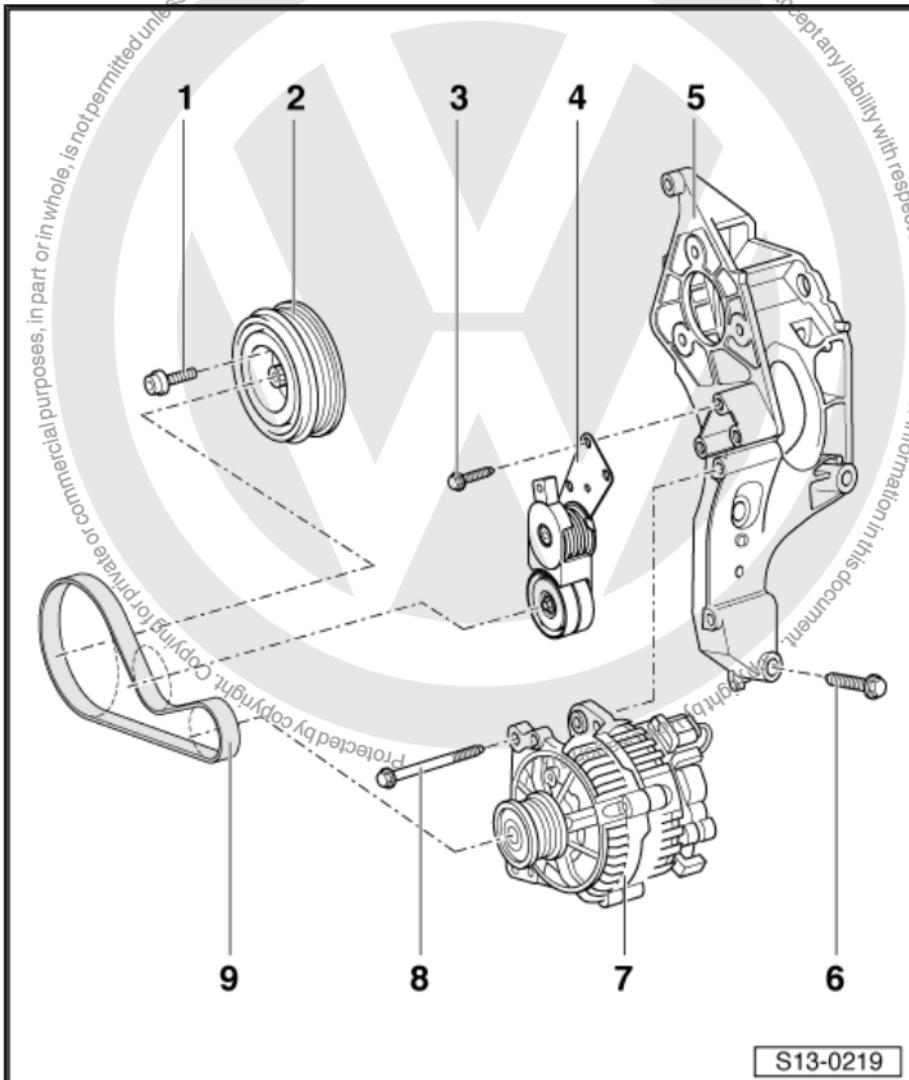
6 - 45 Nm

7 - Generator (Alternator) - C-

8 - 25 Nm

9 - Poly-V belt

- Mark the direction of work prior to removal.
- Check for wear.
- Do not bend.
- Remove and install [⇒ page 15](#) .



S13-0219

Part II



WARNING

Always replace self-locking nuts and screws subject to angular torque



1 - 45 Nm

2 - Engine support

3 - Upper cover to mechanical distributor

4 - Toothed belt

- Mark the direction of rotation prior to removal.
- Check for wear.
- Do not bend.
- Remove and install, adjust [⇒ page 36](#).

5 - 25 Nm

6 - 25 Nm

- Adjust the drive belt [⇒ page 36](#).

7 - 20 Nm

8 - 45 Nm

9 - Camshaft gear

- Toothed belt - remove and install, adjust [⇒ page 36](#).

10 - Tensioning pulley

- Installation position [⇒ page 15](#)
- Check [⇒ page 17](#).

11 - Pulley

12 - Injection pump gear

13 - 10 Nm

14 - 30 Nm

15 - 15 Nm

16 - Front cover of the mechanical distribution

17 - Water pump

- Remove and install [⇒ page 78](#).

18 - Pulley

19 - Crankshaft gear

20 - 30 Nm

21 - Sleeve

22 - Fastening nut

23 - Injection pump

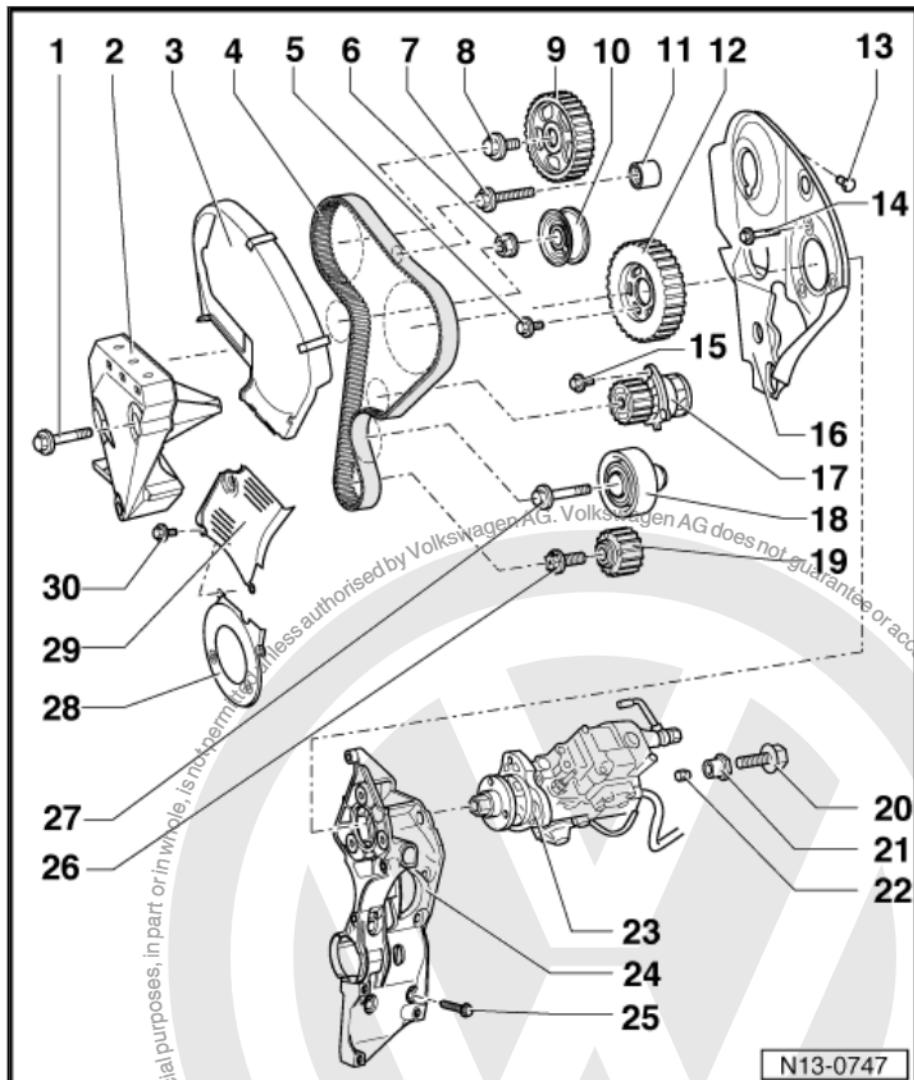
- Remove and install [⇒ page 102](#).

24 - Compact support

25 - 45 Nm

26 - 120 Nm 90°

- Replace after each removal.
- To loosen and tighten, immobilize with the Wrench - 3415-.
- Do not lubricate or grease thread and flange additionally.





- The angular torque can be performed in several stages.

27 - 40 Nm 90°

- Replace after each removal.

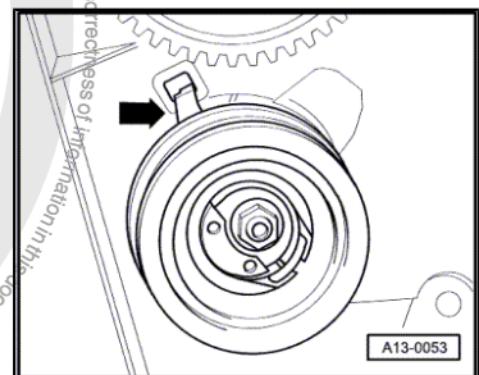
28 - Lower cover to the mechanical distributor

29 - Protector

30 - 10 Nm

Installation position of semi-automatic tensioning pulley of toothed belt

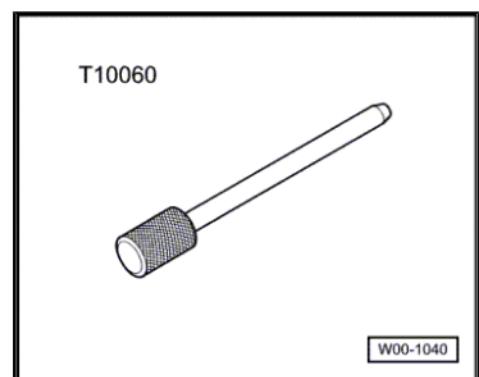
The fastening device -arrow- of tensioning pulley must fit to the groove of the rear cover of mechanical distribution.



1.1 Poly-V belt - remove and install

Special tools and workshop equipment required

- ◆ Pin - T 10060-



1.1.1 Remove the Poly-V belt.

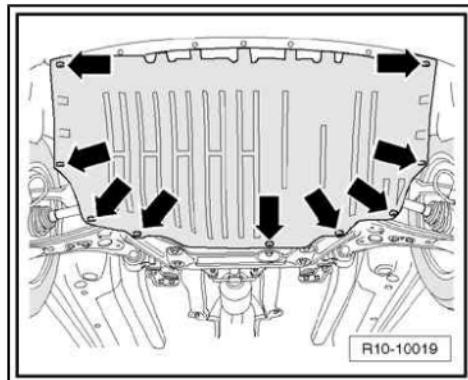


Note

- ◆ Before removing the Poly-V belt, mark the rotation direction.
- ◆ When installing the belt, please ensure the pulley is correctly positioned.

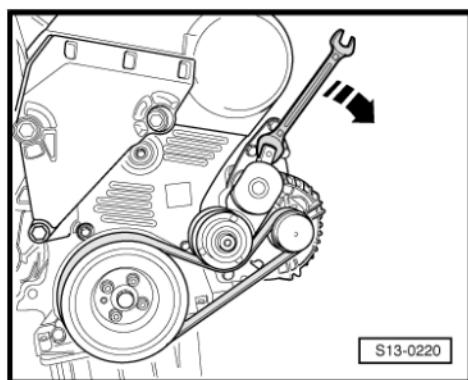


- Remove the noise insulation from the engine.
- Mark the Poly-V belt turning direction.



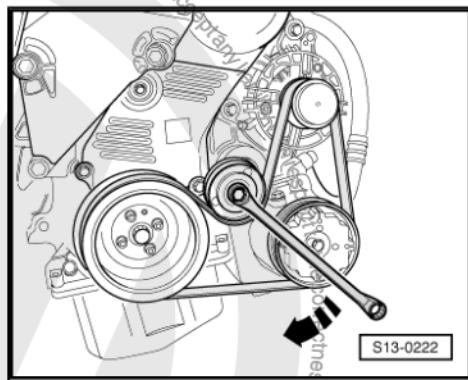
1.1.2 Vehicles without air conditioning compressor.

- With a spanner, turn the tensioning device clockwise -arrow- to release the Poly-V belt.
- Lock the tensioning element with the Pin - T 10060- .
- Remove the Poly-V belt.

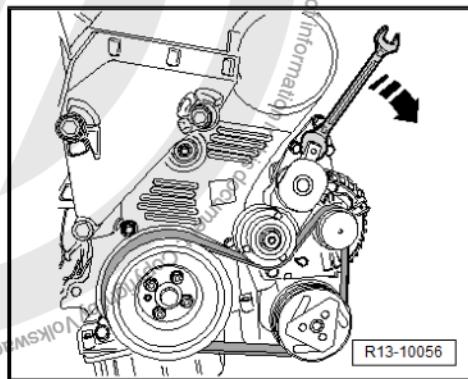


1.1.3 Vehicles with air conditioning compressor

- With a star wrench, turn the tensioning device clockwise -arrow- to release the Poly-V belt.



- With a spanner, turn the tensioning device clockwise -arrow- to release the Poly-V belt.
- Lock the tensioning element with the Pin - T 10060- .
- Remove the Poly-V belt.





1.1.4 Install the Poly-V belt.

- Install in reverse order to the removal.



Note

- ◆ Before installing the Poly-V belt, make sure all assemblies (Generator (Alternator) - C-, air conditioning compressor, power steering pump) are well installed.
- ◆ When installing the Poly-V belt, pay attention to the direction of work and correct fitting of the belt on the respective pulleys.

After finishing work:

- Start engine and check for correct path of the Poly-V belt.

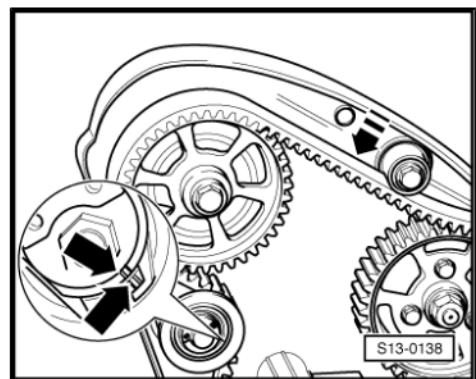
1.2 Toothed belt semi-automatic tensioning pulley - check

1.2.1 Checking conditions

- Toothy belt, installed and adjusted.

1.2.2 Checking sequence

- Press the toothed belt hard -arrow- with a thumb. The notch and protuberance -arrow- must move.
- Release toothed belt. The tensioning pulley must return to its initial position. (The notch and protuberance are overlapped again).
- If the notch and protuberance are not overlapped, release tensioning pulley and adjust toothed belt tension \Rightarrow [page 36](#) .
- If toothed belt tension was changed:
- Check dynamically the injection start, adjust functions and components if necessary \Rightarrow [page 111](#) .





2 Crankshaft and flywheel seal - remove and install



Note

Clutch repair activities: ⇒ Automatic/manual transmission ; Rep. gr. 30 ; Clutch - command system

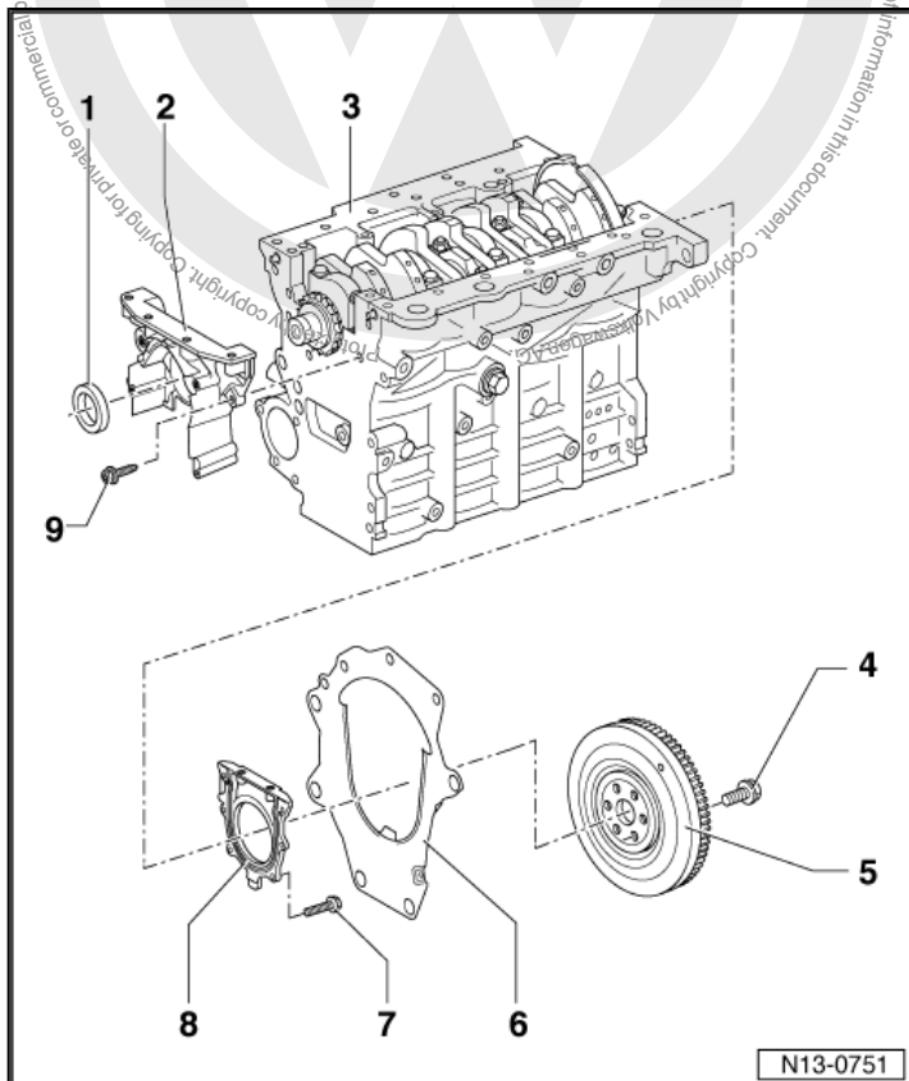


WARNING

Always replace self-locking nuts and screws subject to angular torque

1 - Crankshaft seal (pulley side)

- Do not lubricate or grease the seal lip.
- Before installation, remove oil residues from crankshaft journal with a clean cloth.
- Replace crankshaft seal (pulley side)
⇒ [page 20](#).



N13-0751

4 - 60 Nm 90°

- Replace after each removal.
- The angular torque can be performed in several stages.

5 - Steering wheel

- To remove and install, use the flywheel lock - T 10044- and Sleeve - T 10044/1- ⇒ [page 19](#)

6 - Intermediate plate

- It must be seated on the coupling guides.
- Do not damage/bend during installation.



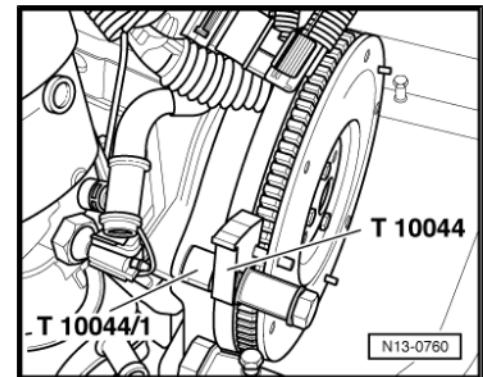
7 - 15 Nm

8 - Crankshaft flange with seal (flywheel side)

- Replace as a set only.
- Do not lubricate or grease the seal lip.
- Before installation, remove oil residues from crankshaft journal with a clean cloth.
- To install, use the supplied coupling guide.
- The coupling guide only can be removed after installing the seal in the crankshaft journal.

9 - 15 Nm

Flywheel - remove and install



Special tools and workshop equipment required

- ◆ Flywheel lock - T 10044- -T10044- with Sleeve - T10044/1-

Fasten the Flywheel lock - T 10044- with Sleeve - T10044/1- to remove and install the flywheel.

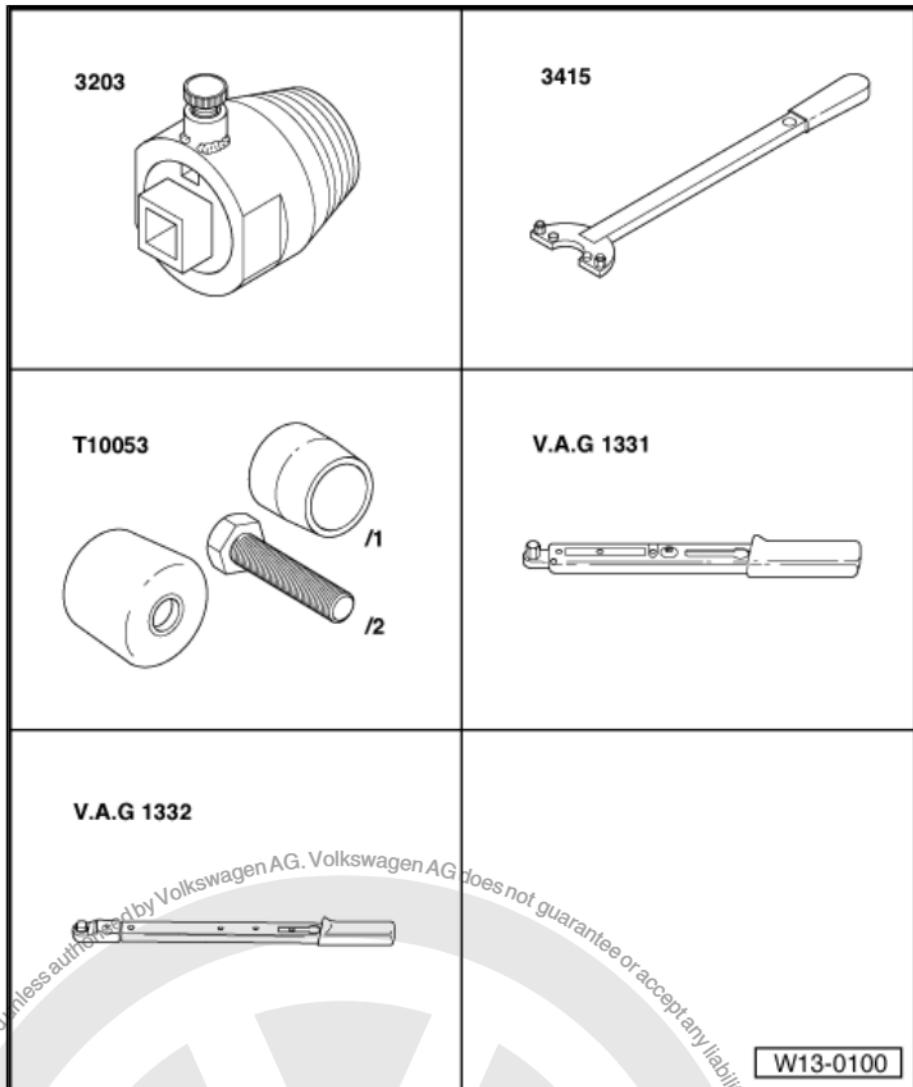




2.1 Crankshaft seal (pulley side) - replace

Special tools and workshop equipment required

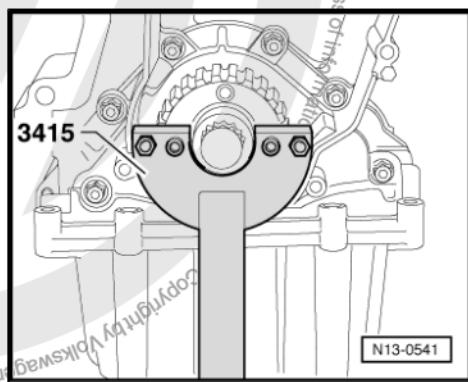
- ◆ Puller - 3203-
- ◆ Key - 3415-
- ◆ Assembly sleeve - T 10053-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-
- ◆ Torque meter - 40 to 200 Nm (enc. 1/2") - VAG 1332-



W13-0100

2.1.1 Removal

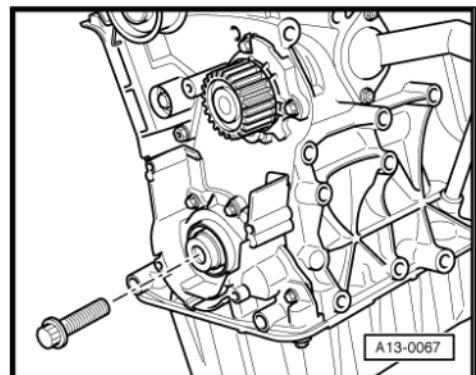
- Remove right front wheel arch trim panel ⇒ General body repairs, exterior; Rep. gr. 66 ; External equipment .
- Remove the Poly-V belt [⇒ page 15](#) .
- Remove toothed belt [⇒ page 36](#) .
- Remove crankshaft gear. Install the crankshaft sprocket and immobilize with the Spanner - 3415- .



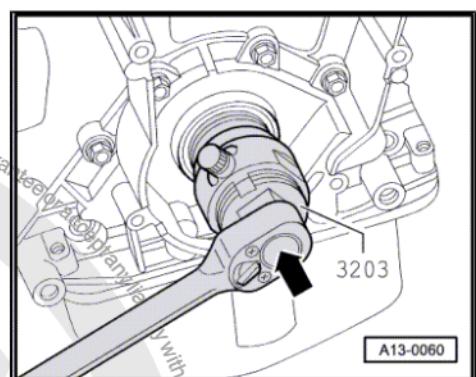
N13-0541



- To guide the Puller - 3203- , install the old clutch securing bolt manually to the crankshaft stop.
- Turn the internal part of the external part of Puller - 3203- nine turns (approx. 20 mm) and block it with the splined bolt.



- Lubricate threaded head of the Puller - 3203- , insert and screw it with strong pressure onto the seal.
- Loosen the splined bolt and turn the inner part of Puller - 3203- against the crankshaft until the seal is extracted.



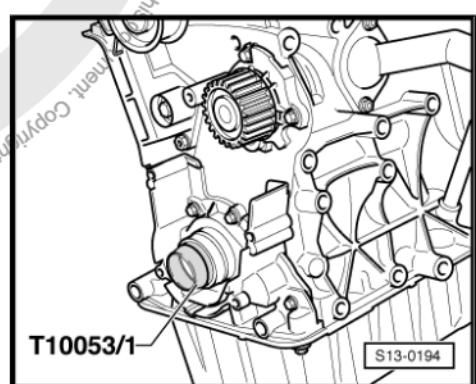
2.1.2 Installation



Note

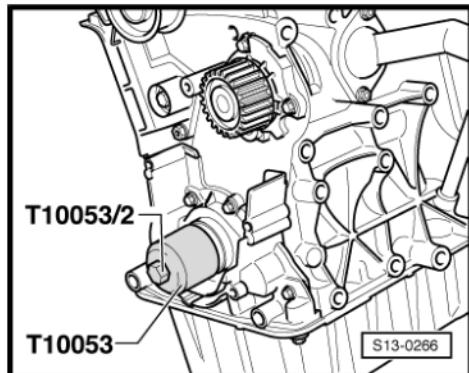
Gradual introduction of PTFE seals (Characteristics: no spring, wider sealing lip). Do not lubricate or grease the seal lip of these seals. An old model of radial-shaft seal (with spring) can be replaced by a PTFE seal, but not the contrary.

- Remove oil residues from crankshaft journal using a clean cloth.
- Place the Sleeve - T10053/1- on crankshaft journal.
- Slide the seal over the Sleeve - T10053/1- , on crankshaft journal, and remove the Sleeve - T10053/1- .





- Install the seal with Assembly sleeve - T 10053- and bolt - T10053/2- (Side turn indicator lamp, left side - M18- x 1,5 x 60), pressing it to the stop.



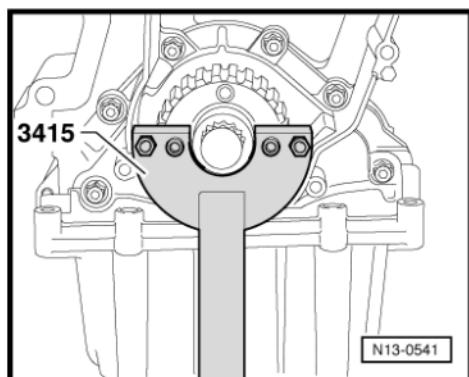
- Install the crankshaft gear and immobilize with the Spanner - 3415- . Fastening torque of the new screw: 120 Nm +90°.



The thread and surface supporting the bolt head must be free of oil and grease.

Installing the toothed belt and adjusting distribution times
[⇒ page 36](#) .

- Install Poly-V belt [⇒ page 15](#) .



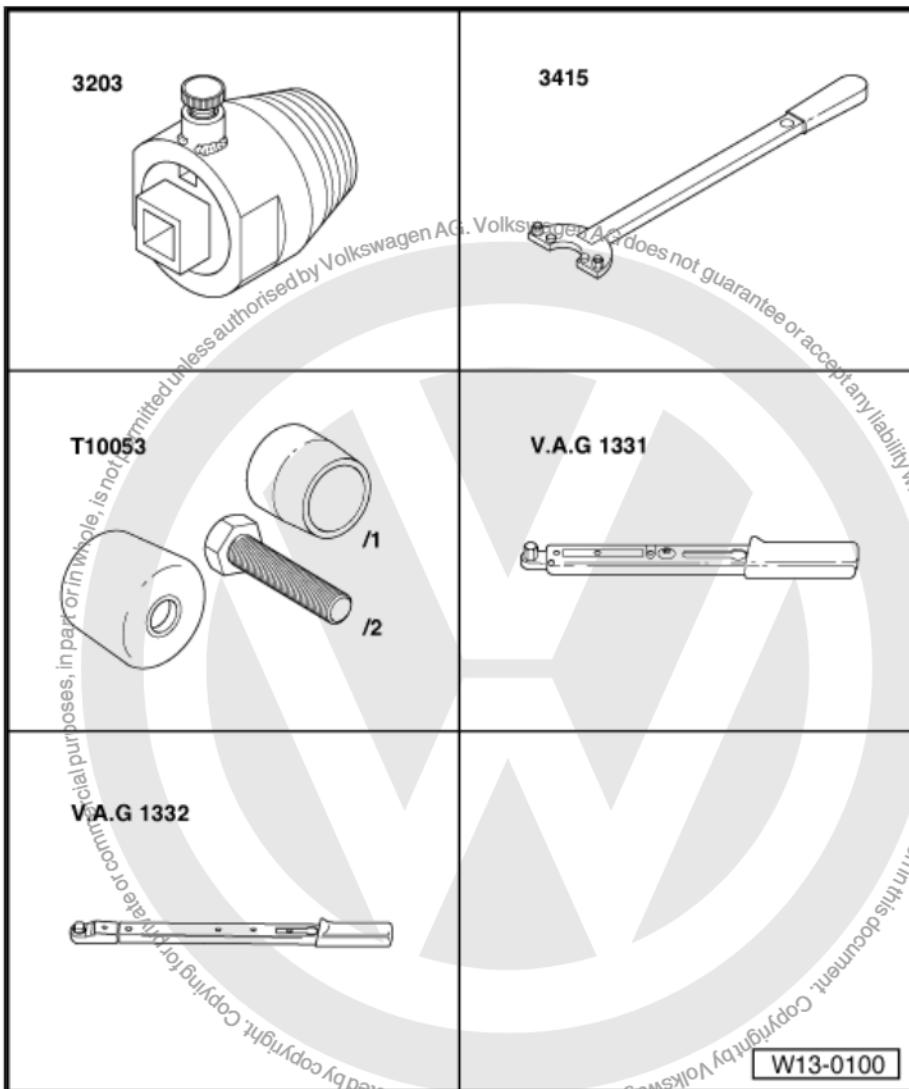
2.2 Crankshaft flanges (flywheel side) - removal and installation





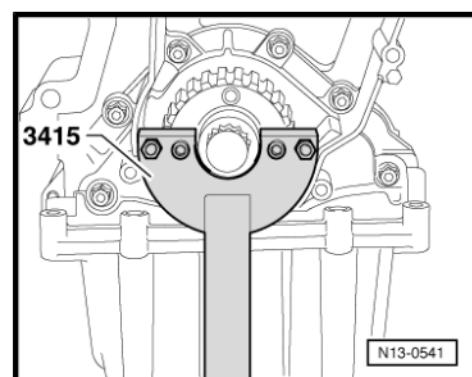
Special tools and workshop equipment required

- ◆ Puller - 3203-
- ◆ Key - 3415-
- ◆ Assembly sleeve - T 10053-
- ◆ Torque wrench - 5 to 50Nm (enc. 1/2") - VAG 1331-
- ◆ Torque wrench - 40 to 200Nm (fit. 1/2") - VAG 1332-



2.2.1 Removal

- Remove the Poly-V belt [⇒ page 15](#) .
- Remove toothed belt [⇒ page 36](#) .
- Remove crankshaft gear. For this purpose, immobilize the gear with the Wrench - 3415- .
- Drain engine oil.
- Remove the crankcase [⇒ page 65](#) .
- Release the front flange.
- Remove front flange, if necessary, release by slightly tapping with a rubber hammer.
- Eliminate residues of Engine silicone sealant - D176 404 A2 ou A3- remaining on the cylinder block, with a flat scraper.





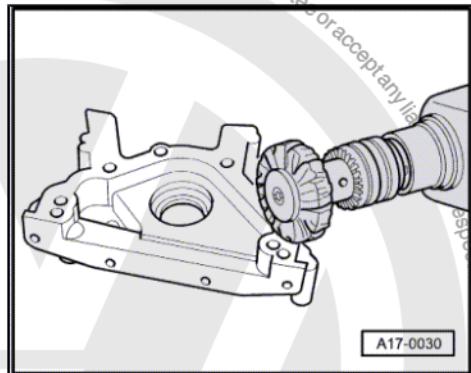
- Remove residues of Engine silicone sealant - D176 404 A2 ou A3- with a plastic brush on drill (use protection goggles).



WARNING

Wear protective goggles!

- Clean the sealing surfaces. They must be free of oil and grease.



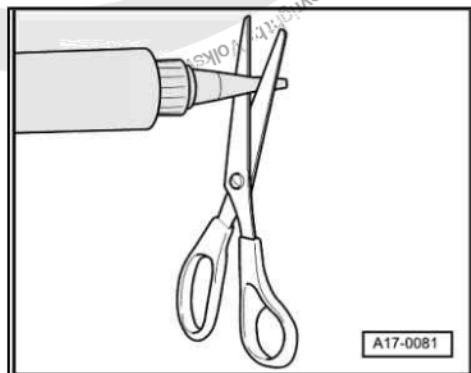
2.2.2 Installation



Note

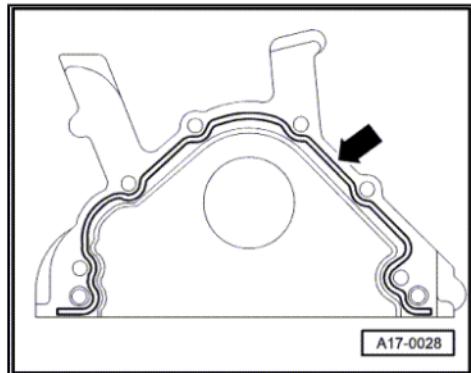
- ◆ *Observe the expiration date of the Engine silicone sealant - D176 404 A2 ou A3- .*
- ◆ *After applying the Engine silicone sealant - D176 404 A2 ou A3- , the flange must be installed within 5 minutes.*

- Cut the pipe applicator on front marking (\varnothing of ejector is approx. 3 mm).



Note

- ◆ *The cord of Engine silicone sealant - D176 404 A2 ou A3- cannot be thicker, otherwise the Engine silicone sealant - D176 404 A2 ou A3- may seep into the crankcase, where it may clog the filter in the suction tube.*
- ◆ *Before applying the cord of Engine silicone sealant - D176 404 A2 ou A3- , cover the seal surface with a clean cloth.*



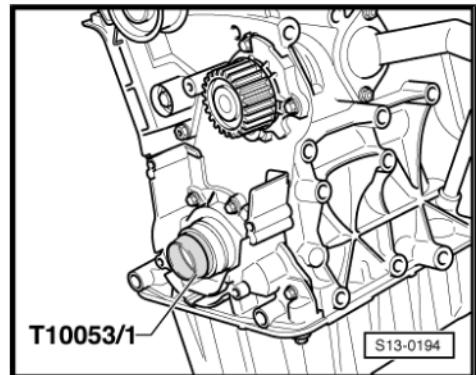
- Apply the cord of Engine silicone sealant - D176 404 A2 ou A3- on the clean sealing surface of flange, as shown in the illustration.
- Install flange immediately and lightly tighten all the securing bolts.



Note

For positioning of the flange with installed seal, use the Sleeve - T10053/1- .

- Install the flange securing bolts alternately in a cross pattern. Tightening torque: 15 Nm.
- Install crankcase [⇒ page 65](#) .



Note

After installation, the Engine silicone sealant - D176 404 A2 ou A3- must dry for 30 minutes. Replenish with engine oil only after this period has elapsed.

- Install the crankshaft gear and immobilize with the Spanner - 3415- . Tightening torque: 120 Nm + 90°.

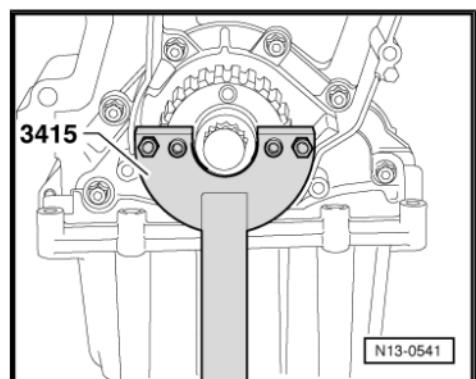


Note

The thread and surface supporting the bolt head must be free of oil and grease.

Installing the toothed belt and adjusting distribution times
[⇒ page 36](#) .

- Install Poly-V belt [⇒ page 15](#) .





3 Crankshaft - remove and install



WARNING

Always replace self-locking nuts and screws subject to angular torque

1 - Bearing shells 1, 2, 4 and 5

- For bearing cover without lubrication groove.
- For engine block with lubrication channel.
- Do not mix the bearing shells when reusing them (mark them)

2 - 65 Nm 90°

- Replace after each removal.
- To measure the radial clearance, tighten to 65 Nm, without angular torque.

3 - Bearing cap

- Bearing cap 1: crankshaft pulley side:
- Bearing cover 3: With grooves for fitting rings.
- Positioning protrusions of engine block/ bearing cover must be overlapped.

4 - Bearing 3 sleeve

- For bearing cover without lubrication groove.
- For engine block, with lubrication groove.

5 - Adjustment rings

- For bearing cap 3.
- Check fastening.

6 - Rotor

- To the Engine speed sensor - G28- .

7 - 10 Nm 90°

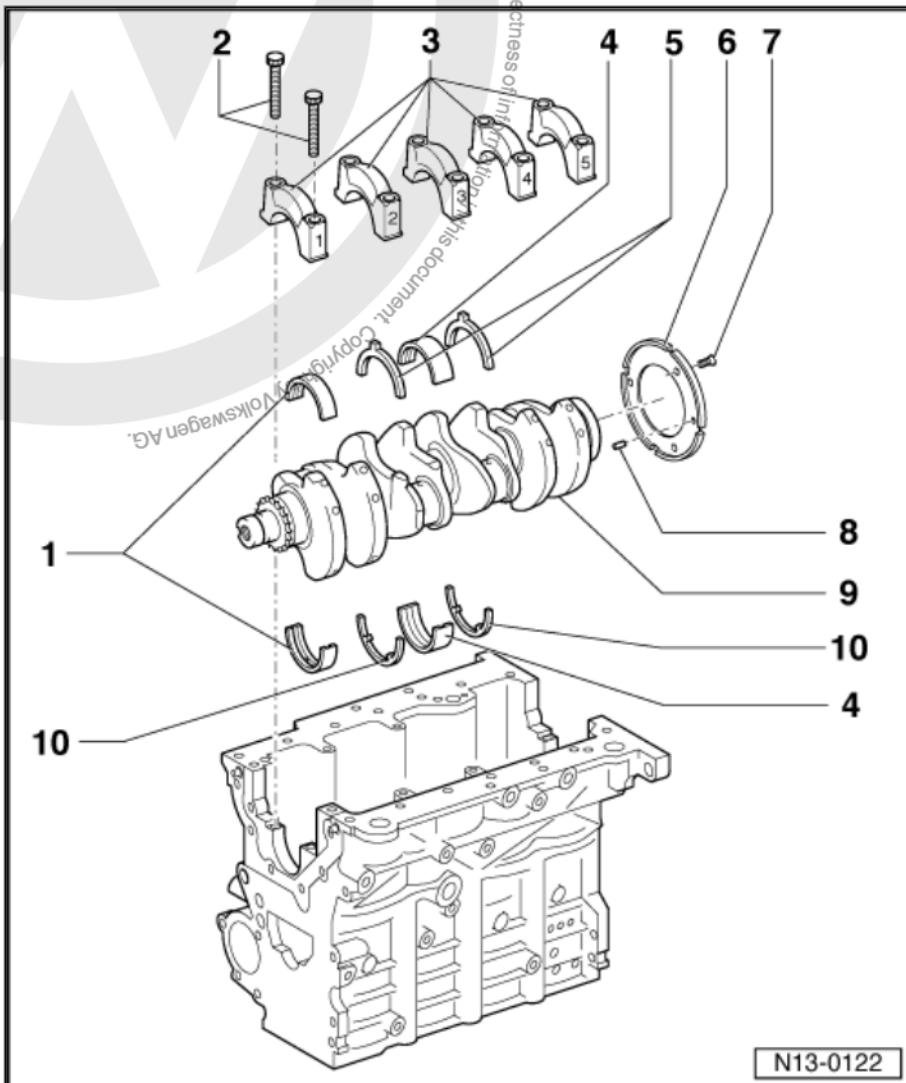
- Replace after each removal.

8 - Adjustment pin

- Check projection on crankshaft [⇒ page 15](#)

9 - Crankshaft

- New axial clearance: 0.07...0.17 mm. Wear limit: 0.37 mm.
- Measure radial clearance with "Plastigage": new: 0.03...0.08 mm. Wear limit: 0.17 mm.
- Do not turn the crankshaft while measuring radial clearance.
- Crankshaft measurements [⇒ page 26](#) .

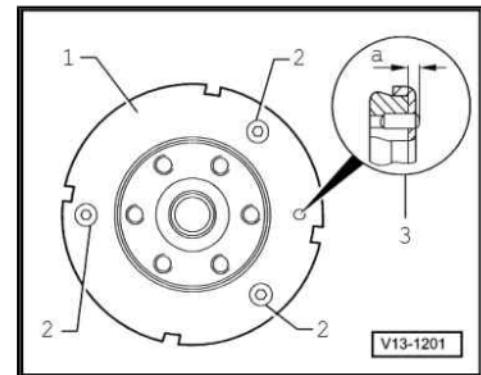




10 - Adjustment rings

- For cylinder block, bearing 3.
- Check fastening.

Check projection of adjustment pin on crankshaft



Special tools and workshop equipment required

- ◆ Depth pachymeter

Checking sequence

- Check projection -a- of adjustment pin on crankshaft, with flywheel removed -1-, with a feeler gauge. -1- Flywheel. -2- Securing bolt. -3- projection of adjustment pin $a = 2,5 \dots 3,0$ mm.

3.1 Crankshaft measurements

(measures in mm)

Grinding measurements	Crankshaft bearing journal-Ø	Conrod bearing crank web-Ø
basic measurement	-0,022 54,00 -0,042	-0,022 47,80 -0,042
First grinding	-0,022 53,75 -0,042	-0,022 47,55 -0,042
Second grinding	-0,022 53,50 -0,042	-0,022 47,30 -0,042
Third grinding	-0,022 53,25 -0,042	-0,022 47,05 -0,042



4 Pistons and connecting rods - removal and installation



Note

All contact and bearing surfaces must be lubricated with oil before assembly.



WARNING

Always replace self-locking nuts and screws subject to angular torque

1 - Piston rings

- Remove and install with ring pliers.
- Move openings 120°.
- Mark "TOP" points towards the piston head.
- Check opening between ends [⇒ page 29](#)
- Check ring clearance in the piston groove [⇒ page 30](#)

2 - Piston

- With combustion chamber.
- Mark installation position and the correspondence to the respective cylinder.
- Piston/cylinder installation position [⇒ page 31](#)
- Arrow- on piston crown points to the pulley side.
- Install with ring compression strap.
- In case of cracks on piston, replace it.
- Check piston protrusion [⇒ page 31](#).

3 - Piston pin

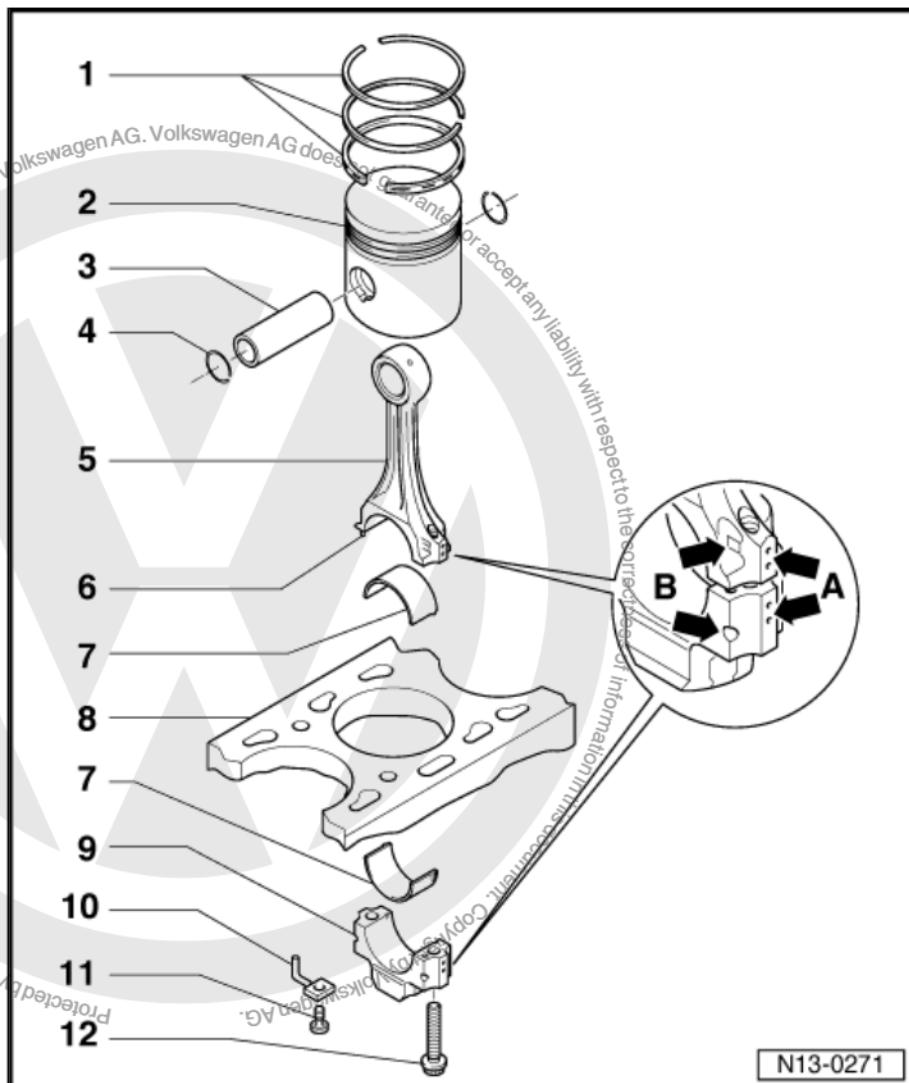
- In case of difficulties during removal, heat piston to 60°C.
- Remove and install with Puller and Fitter - VW 222- .

4 - Piston pin retaining ring

- Replace.

5 - Connecting rod

- Replace as a set only.





- Mark corresponding position relative to cylinder -A-.
- Installation position: Marks -B- point to the pulley side.

6 - Adjustment pin

- The adjustment pin must be firmly positioned in the conrod.

7 - Bearing shell

- Pay attention to the correct assembly position.
- Do not mix used bearing shells (mark them).
- Pay attention to proper seating of the retaining projections.
- Axial clearance: wear limit: 0.37 mm.
- Check radial clearance with "Plastigage": wear limit: 0.08 mm. Do not turn crankshaft while measuring radial clearance.

8 - Engine block

- Check cylinder diameter [⇒ page 30](#)
- Piston and cylinder dimensions [⇒ page 32](#) .

9 - Connecting rod cap

- Pay attention to the correct assembly position.

10 - Oil ejector

- For piston cooling.

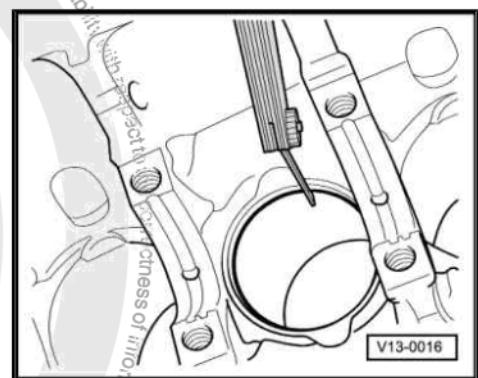
11 - 25 Nm

- Install without sealant.

12 - Connecting rod bolt, 30 Nm + 90°

- Replace after each removal.
- Lubricate the thread and supporting surface.
- To measure radial clearance, use the old bolt.

Openings of piston ring ends - check



Special tools and workshop equipment required

- ◆ Feeler gauge

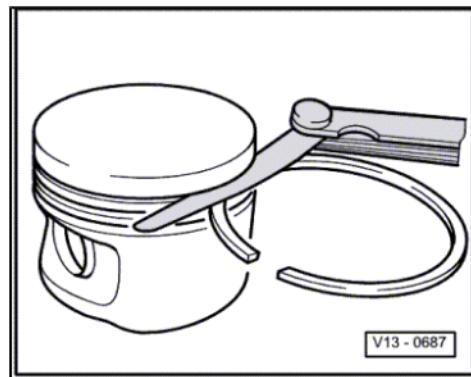
Checking sequence

- Insert the ring at right angle from top to the cylinder lower opening, with a distance of approx. 15 mm to cylinder edge.

Segment ring measurements in mm	new	Wear limit
1. Compression ring	0,25...0,40	1,0
2. Compression ring	0,20...0,40	1,0
Oil scraper ring	0,25...0,50	1,0



Check ring clearance in the piston groove



Special tools and workshop equipment required

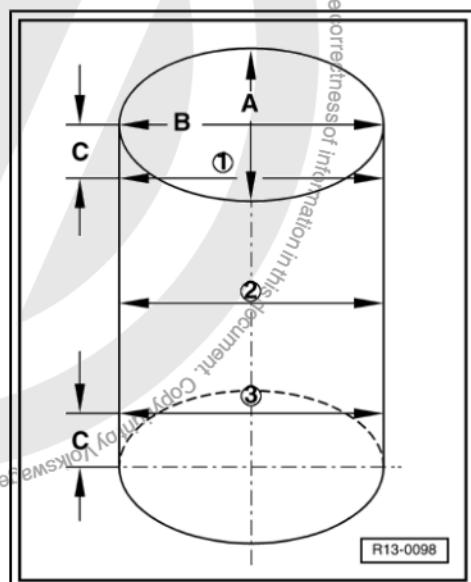
- ◆ Feeler gauge

Checking sequence

Clean the groove of the piston prior to verification.

Segment ring measurements in mm	new	Wear limit
1. Compression ring	0,06...0,09	0,25
2. Compression ring	0,05...0,08	0,25
Oil scraper ring	0,03...0,06	0,15

Check cylinder diameter



Special tools and workshop equipment required

- ◆ Precision internal micrometer 50...100 mm

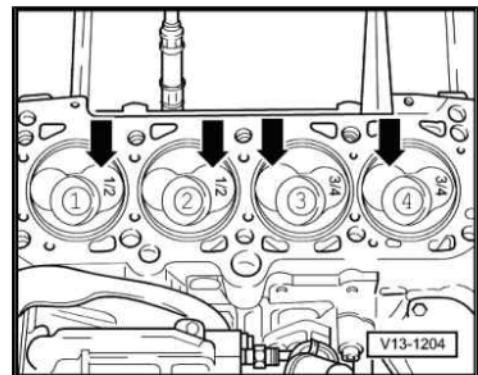
Checking sequence

Measure at three different points, in cross pattern, in transversal -A- and longitudinal -B- directions, with a distance of 10.0 mm from upper and lower edges -C-. Tolerances in relation to max. nominal measure 0.10 mm.



Note

The cylinder diameter should not be measured while the engine block is secured to the assembly stand with the Support - VW 540- or Rotary stand for engine and gearbox - VAS 6095-, because this can produce wrong measures.



Piston - Piston/cylinder installation position

Piston for cylinders 1 and 2:

Larger chamber for the intake valve facing the flywheel side
 -arrows-.

Piston for cylinders 3 and 4:

Larger chamber for the intake valve facing the pulley side
 -arrows-.



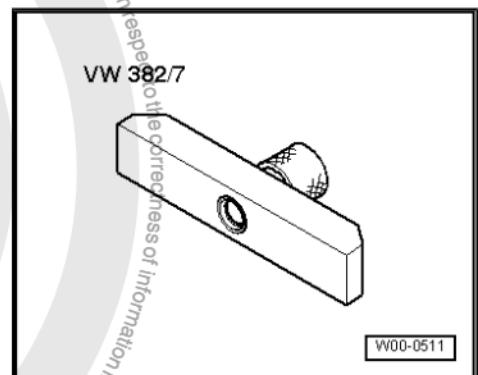
Note

- ◆ For new pistons, the position in cylinder is marked in colours onto the piston crown.
- ◆ Piston for cylinders 1 and 2: Marking 1/2
- ◆ Piston for cylinders 3 and 4: Marking 3/4

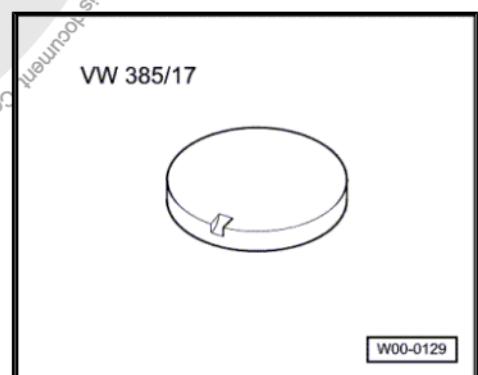
4.1 Piston protrusion - check

Special tools and workshop equipment required

◆ Measuring bridge - VW 382/7-



◆ Measuring disc - VW 385/17-

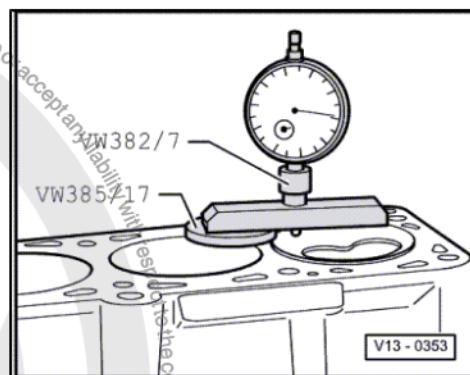


◆ Dial gauge

4.1.1 Checking sequence

When installing new pistons or engine part, check piston protrusion. Depending on the measurement value, the corresponding head seal must be installed as per the following table:

Piston protrusion	Identification: Notches/Holes
0,91 mm ... 1,00 mm.	1
1,01 mm ... 1,10 mm.	2
1,11 mm ... 1,20 mm.	3

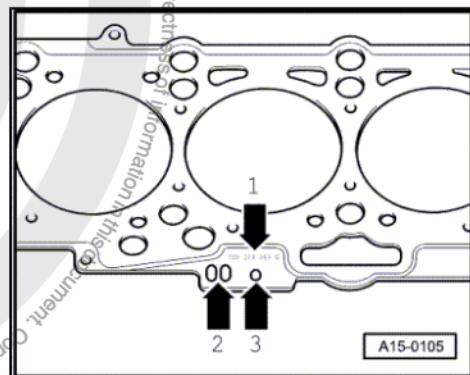


4.1.2 Identification of cylinder head gasket

- ◆ Spare part number = -arrow 1-
- ◆ Tax code = -arrow 2- (not relevant!)
- ◆ Holes ~~number~~ -arrow 3-



If measurement of piston protrusion results in different values, the higher measure is the valid one to gasket attribution.



4.2 Piston and cylinder dimensions

Wear measure	Piston-Ø	cylinder inside-Ø
Basic measure- ment	mm	79,47
Grinding I	mm	79,72
Grinding II	mm	79,97



15 – Cylinder head, valve gear

1 Cylinder head - assembly and disassembly

Check compression [page 47](#)



Note

- ◆ When installing a remanufactured cylinder head with camshaft installed, it is necessary to lubricate contact surfaces between tappet and eccentric pins, before installing the cylinder head cover.
- ◆ The plastic shims included for open valve protection should only be removed immediately before installing the cylinder head.
- ◆ When replacing the cylinder head, all coolant must also be replaced.



WARNING

Always replace self-locking nuts and screws subject to angular torque



1 - Cylinder head sealing gasket

- Replace.
- Check the identification
⇒ [page 35](#)
- After replacing, replace all coolant.

2 - 20 Nm

3 - Engine cylinder head

- Check warping
⇒ [page 35](#)
- Remove and install
⇒ [page 41](#)
- After replacing, replace all coolant.

4 - Suspension support

5 - 8 Nm

- For engine cover.
- Not applicable.

6 - Cylinder head fastening screw

- Replace after each removal.
- Follow the sequence for removal and installation
⇒ [page 41](#).

7 - Oil deflector

8 - Cylinder head cover

- With vulcanized gasket.

9 - Sealing ring

- Replace when damaged.

10 - Oil reservoir lid

- Replace gasket, if damaged.

11 - Crankcase ventilation line

12 - Clamp

13 - Crankcase ventilation valve

- For crankcase ventilation.

14 - Sealing

- Replace when damaged.

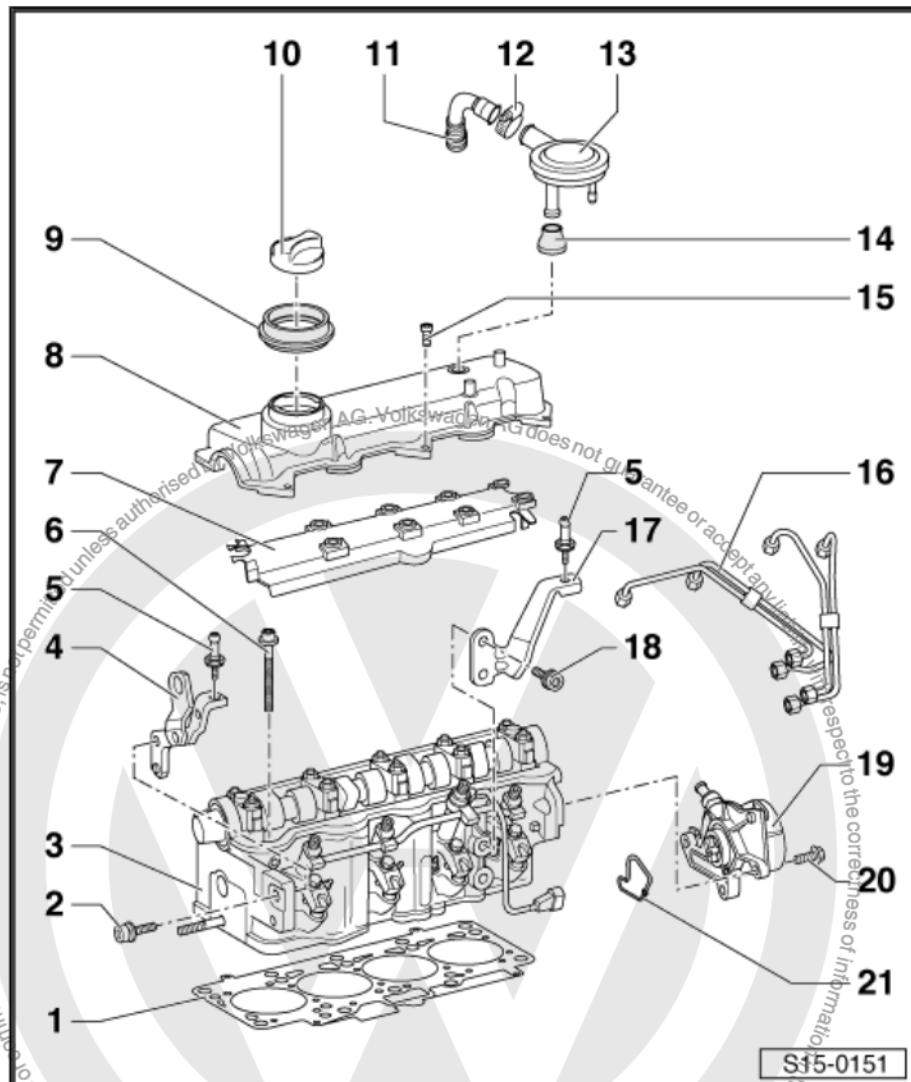
15 - 10 Nm

16 - Injection Tubes

- Tighten them to 25 Nm.
- Remove with Open star wrench - 3035- .
- Always remove the entire assembly.
- Do not change the curvature.

17 - Support

- For engine cover.
- Not applicable.





18 - 20 Nm

19 - Vacuum pump

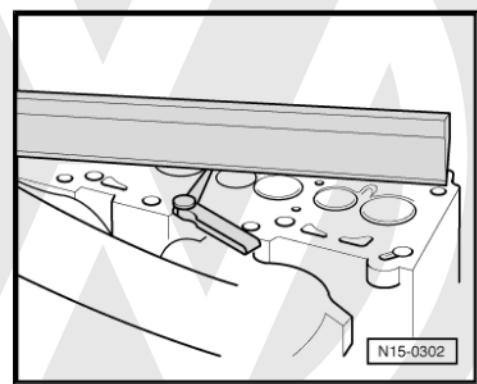
- To brake servo.

20 - 20 Nm

21 - Gasket

- Replace.

Cylinder head - check for warping



Special tools and workshop equipment required

- ◆ Feeler gauge
- ◆ Auxiliary ruler

Checking sequence

Max. permissible bending: 0.10 mm.

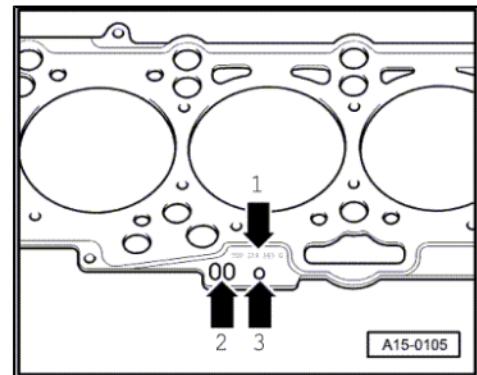


Note

Reworking of cylinder heads in diesel engines is not allowed.

Cylinder head gasket - identification

- ◆ Spare part number = -arrow 1-
- ◆ Tax code = -arrow 2- (not relevant!)
- ◆ Holes = -arrow 3-



Note

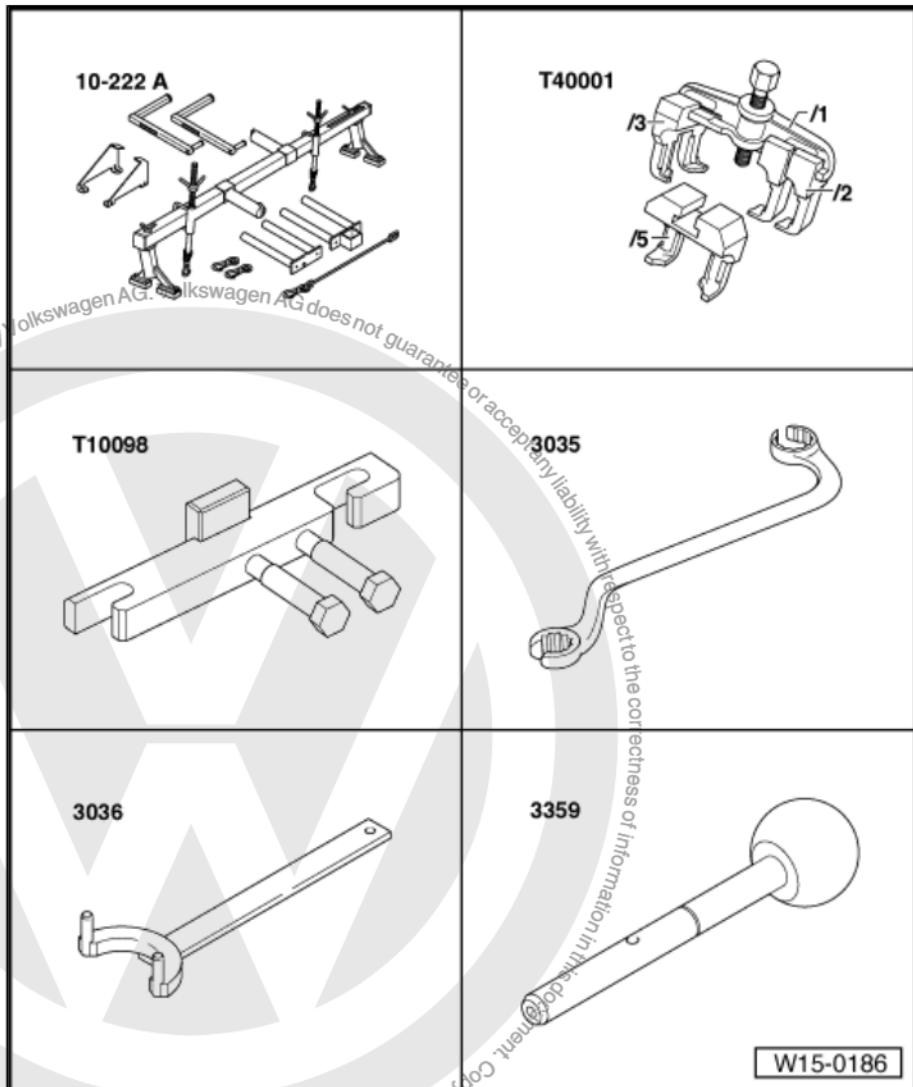
Depending on piston protrusion, gaskets with different thicknesses can be installed. When replacing the gasket, install gasket with similar identification.



1.1 Toothed belt - remove and install, adjust

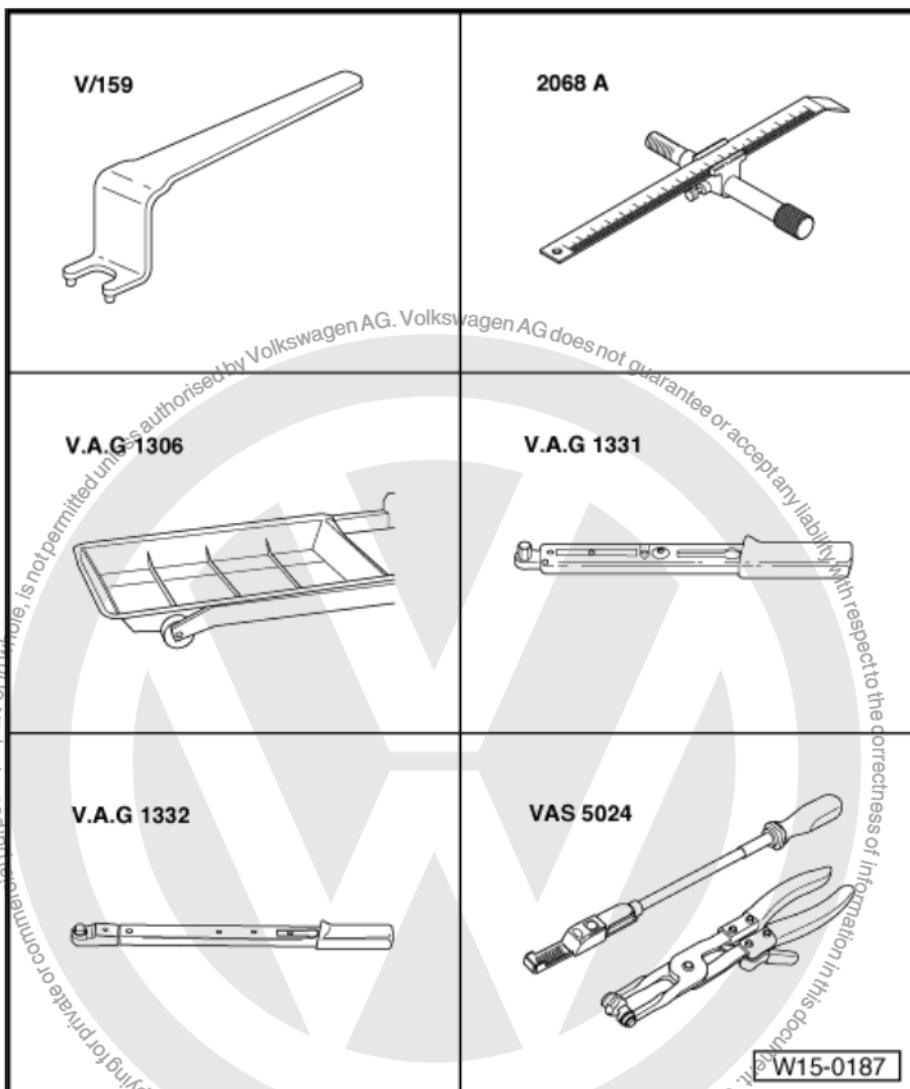
Special tools and workshop equipment required

- ◆ Supporting device - 10 - 222A- with feet - 10 - 222A/1-
- ◆ Puller - T 40001-
- ◆ Alignment bar - T 10098A-
- ◆ Special wrench - 3036-
- ◆ Lock pin - 3359-
- ◆ Key - V 159-



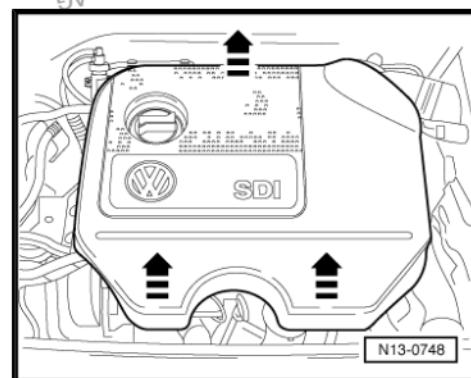


- ◆ Device for top dead centre adjustment. - 2068 A-
- ◆ Oil collecting tray - VAG 1306-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-
- ◆ Torque meter - 40 to 200 Nm (enc. 1/2") - VAG 1332-
- ◆ VW 5162 or Standard type clamp pliers - VAS 5024A-



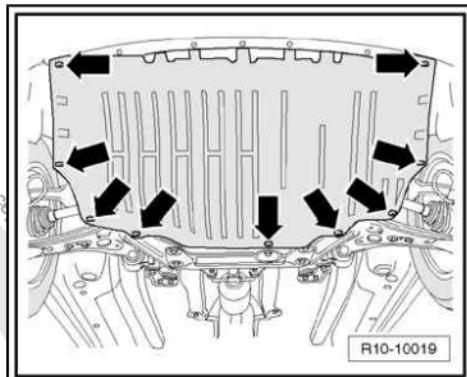
1.1.1 Removal

- Remove the engine cover, -arrows-
- Remove the Poly-V belt ⇒ page 15.
- Remove upper cover from mechanical distributor.
- Remove the vacuum pump of the servo brake.

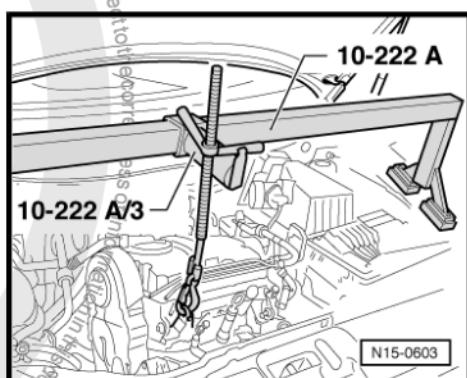




- Remove the noise insulation from the engine.



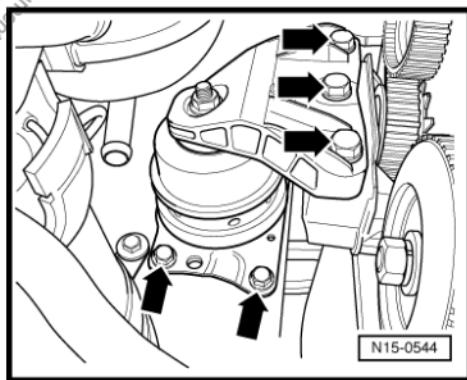
- Place the Support - VW 061 (VWB) - ou - 10-222A- as illustrated and support the engine in the assembly position.
- Slightly raise the engine.



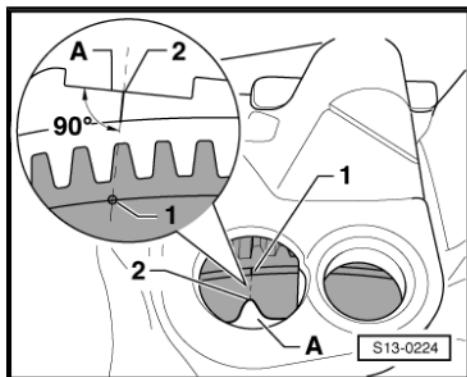
- Release securing bolts from ancillary bracket, engine, ancillary bracket, gearbox and support to mounting assembly/body -arrows-, and remove the entire support.
- Remove upper cover from mechanical distributor.

 Note

- ◆ The ancillary bracket for engine can only be removed with the engine anchored with the Support - VW 061 (VWB) - ou - 10-222A- !
- ◆ The engine support can be released after the ancillary bracket has been removed.
- ◆ To release the bolt from ancillary bracket, engine, it is necessary to slightly raise the engine with help of the Support - VW 061 (VWB) - ou - 10-222A- .



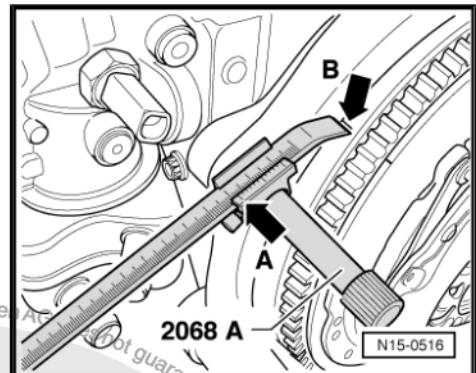
- Install engine support in the cylinder block.
- Turn the crankshaft to OT, cylinder 1.
- The mark on flywheel -1- must be aligned to the mark on gearbox -2-.



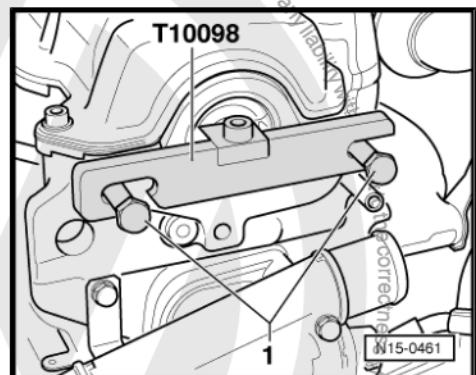


Note

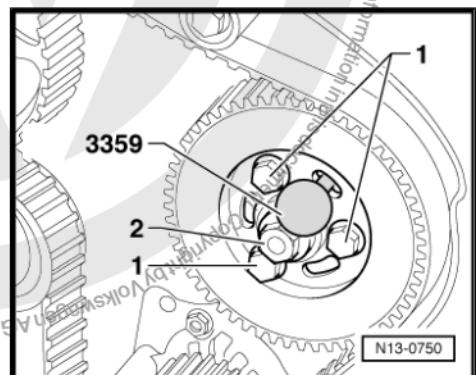
- ◆ For this, observe the reamed surface on gearbox -A- perpendicular to the flywheel mark.
- ◆ After removing engine:
- ◆ Install the Adjustment device to Top Dead Centre - 2068 A- as shown.
- ◆ Adjust the Adjustment device to Top Dead Centre - 2068 A- to 120 mm. The nonius left notch is the -arrow A- reference point.
- ◆ Turn the crankshaft until the OT mark on flywheel aligns with the tip of the adjustment -arrow B- device



- Manually install the adjustment bolts -1- to the stop.
- Lock the camshaft as shown with the Alignment rod - T 10098A- .



- Lock the injection pump gear with the Lock pin - 3359- .
- Loosen the bolts -1- that secure the injection pump gear.
- Remove lower cover to mechanical distributor.
- Remove pulley/vibration damper.
- Mark the operation direction of the toothed belt.
- Release the tensioning roller.
- Remove toothed belt.



1.1.2 Installation

- Check if the OT mark on flywheel aligns with the reference mark.
- Loosen the camshaft gear bolt with one turn. To loosen the bolt, immobilize the camshaft gear with a Pin wrench - 3036- .

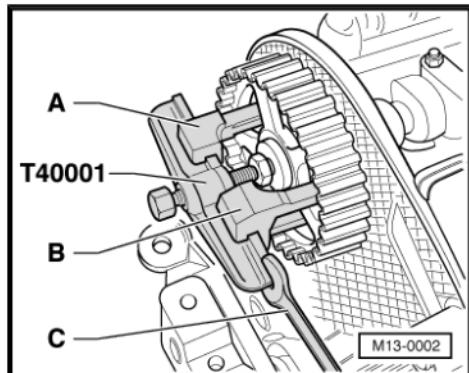


Note

To loosen and tighten the camshaft gear, never use the Alignment rod - T 10098A- for immobilization! Use the Pin wrench - 3036- .



- Place the Puller - T 40001- with the one-arm claw - T40001/2-A- and Two-arm claw - T40001/3-B- centred over the cam-shaft gear, and remove the gear. Use a spanner -C- as a support.
- Install the toothed belt in the crankshaft gear, pulley, injection pump gear, water pump gear, and tension pulley (check the direction of rotation).
- Centralize the injection pump gear with the holes.
- Install the camshaft gear with the toothed belt and fasten them with the securing bolt (the camshaft gear still remains mobile).



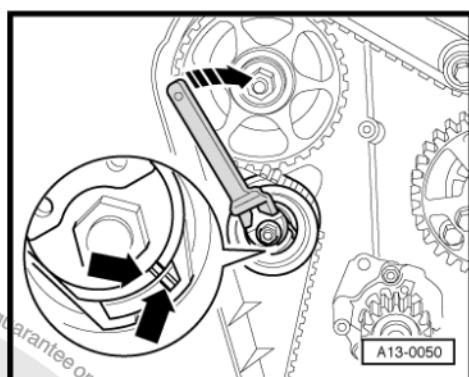
- Adjust the timing belt. For that, turn the Wrench - V 159- on eccentric clockwise, until the notch and protuberance -arrows- coincide.



Note

If the eccentric is too much protruded, the tension pulley must be totally released and re-adjusted. The eccentric cannot be corrected to the additional measure.

- Tighten the lock nut on tensioning pulley. Tightening torque: 25 Nm.
- Check again if the OT mark on flywheel aligns with the reference mark.

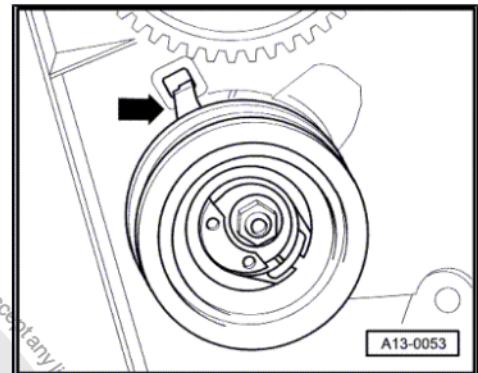




Note

The fastening device -arrow- of tensioning pulley must fit to the groove of the rear cover of mechanical distribution.

- Check the OT mark on flywheel again.
- Tighten camshaft gear securing bolt. Tightening torque: 45 Nm.
- Tighten camshaft gear securing bolt. Tightening torque: 25 Nm
- Remove the Alignment rod - T 10098A- .
- Remove the Lock pin - 3359- .
- Turn the camshaft two turns to the direction of engine rotation until the camshaft returns to TDC for cylinder 1.
- Check if the OT mark on flywheel to adjustment ruler on cam-shaft the Lock pin - 3359- fits to the injection pump gear for tensioning pulley adjustment (notch/protuberance).
- If the notch or protuberance or notch -arrow- are not overlapped, adjust the tensioning pulley and tighten the nut to 25 Nm.
- Turn the camshaft two turns to the direction of engine rotation until the camshaft returns to TDC for cylinder 1.
- Repeat the test.
- Install engine support in the cylinder block. Tightening torque 45 Nm.



Note

Before installing the assembly mounting, all bolts supporting the engine must have been tightened to the specified tightening torque.

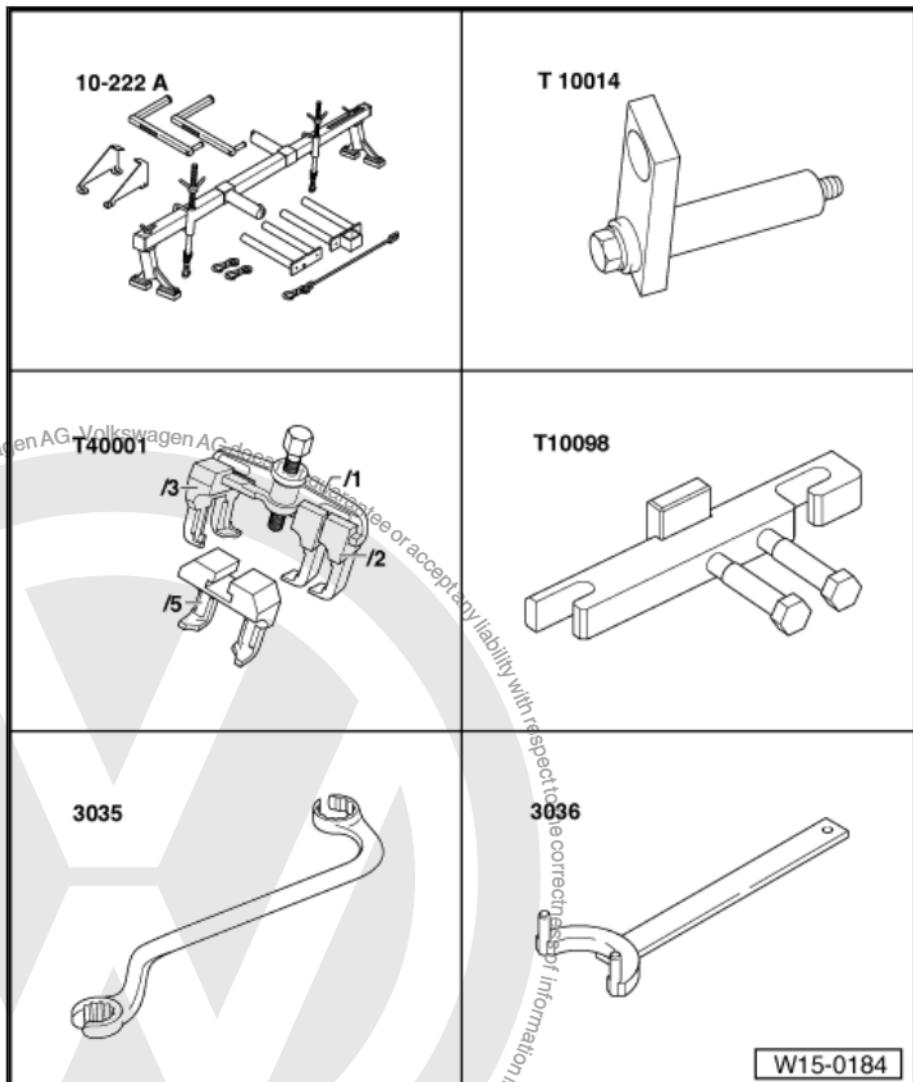
- Install ancillary bracket, engine Tightening torque [⇒ page 8](#) .
- Install vacuum pump.
- Install mechanical distribution cover and pulley/vibration damper of the camshaft.
- Install Poly-V belt [⇒ page 15](#) .
- Install the lower engine noise insulation.
- Install the upper cover of the mechanical distribution.
- Perform test run and check event memory [⇒ page 110](#) .
- Check dynamically the injection start, adjust functions and components if necessary [⇒ page 111](#) .

1.2 Cylinder head - remove and install



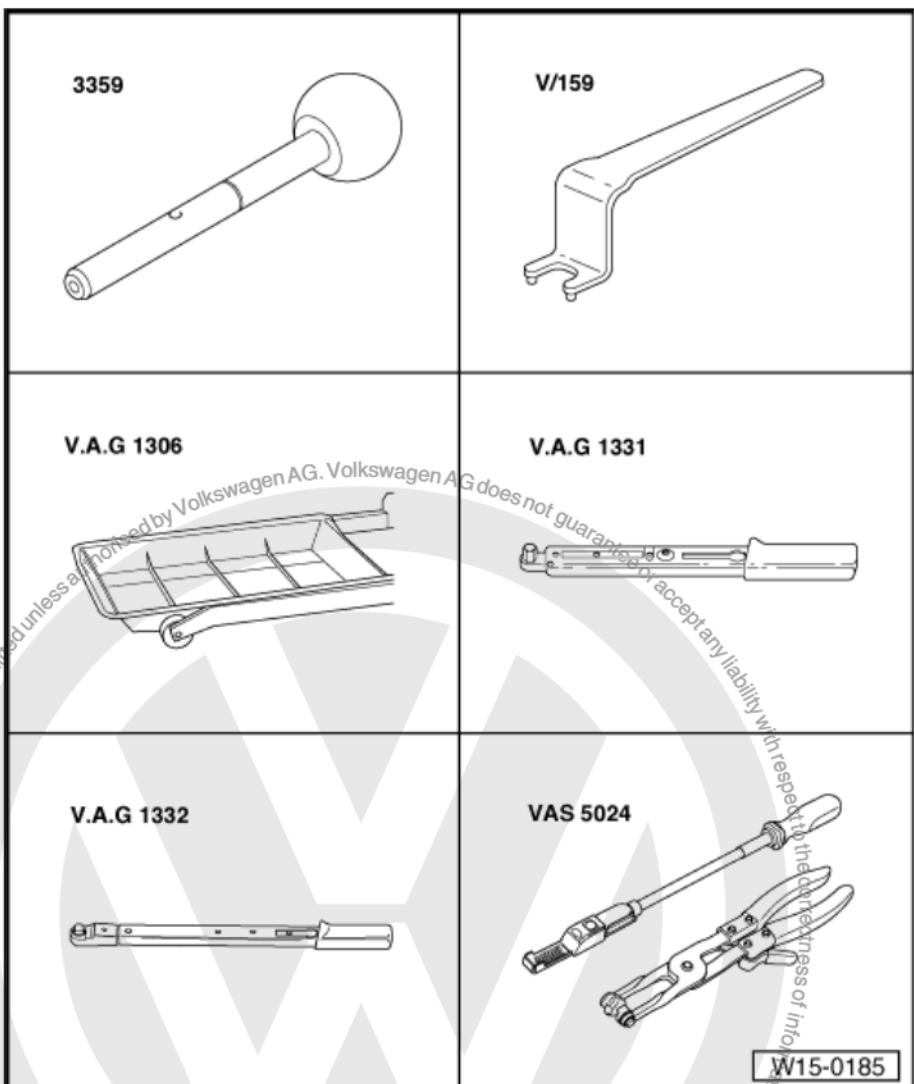
Special tools and workshop equipment required

- ◆ Support or VW 061 - 10-222A-
- ◆ Support - T 10014-
- ◆ Puller - T 40001-
- ◆ Alignment bar - T 10098A-
- ◆ Star socket - 3035-
- ◆ Special wrench - 3036-
- ◆ Lock pin - 3359-





- ◆ Key - V 159-
- ◆ Oil collecting tray - VAG 1306-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-
- ◆ Torque meter - 40 to 200 Nm (enc. 1/2") - VAG 1332-
- ◆ VW 5162 or Standard type clamp pliers - VAS 5024A-



1.2.1 Conditions

- The engine must be at most at a temperature that allows touching it with the hand.
- None of the pistons must be in Top Dead Centre.

1.2.2 Removal

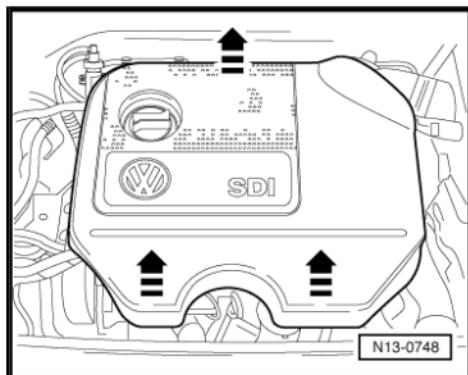


Note

During the work, the Battery - A- earth strap must be disconnected. First, check if the vehicle is equipped with a coded radio. If so, obtain the anti-theft code prior to beginning work.



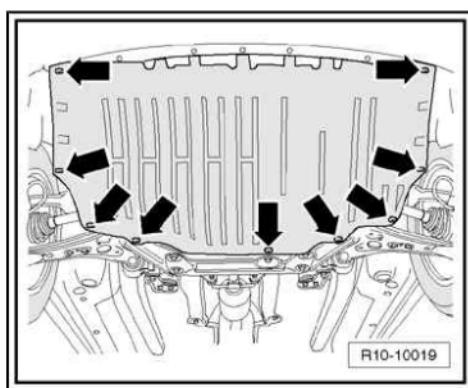
- Remove the engine cover, -arrows-
- With the ignition turned off, disconnect the earth wire from the battery - A- .
- All the clamps that are open or removed to remove the engine shall during assembly be installed again at the same points.



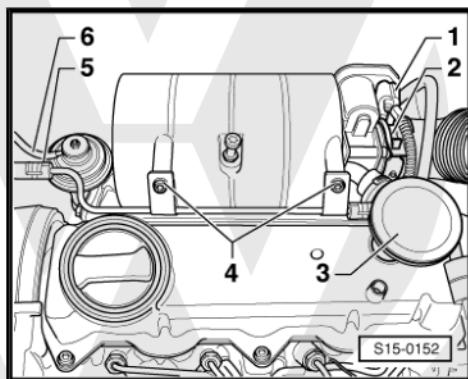
- Remove the noise insulation from the engine.
- Remove the front section of exhaust tube with catalytic converter [⇒ page 113](#) .
- Drain cooling system [⇒ page 75](#) .
- Remove the tubes from injectors.

 Note

- ◆ *To release the injection tubes, use the Open ring spanner - 3035- .*
- ◆ *Always remove the entire assembly.*
- ◆ *Do not change the curvature.*

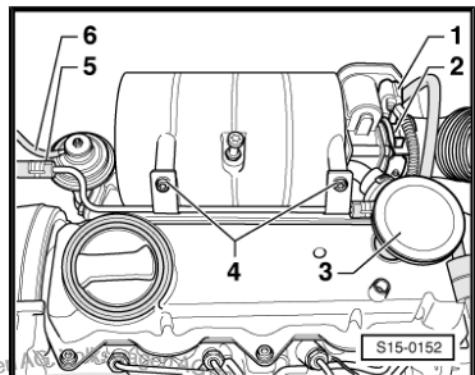


- Cover the openings with a clean cloth.
- Disconnect the return lines of injectors/injection pump
- Disconnect the connection bar of glow plugs.
- Remove vacuum tubes in cylinder head.
- Disconnect and loosen the remaining electric connections from engine.
- Remove connector to the intake tube flap -1-.
- Remove the suction tube from flap -2- in suction tube.
- Remove the crankcase ventilation valve -3- with relief tube connected.





- Loosen bolts -4- from intake tube.
- Disconnect the hose from cooling system -5- and vacuum hose-6-.



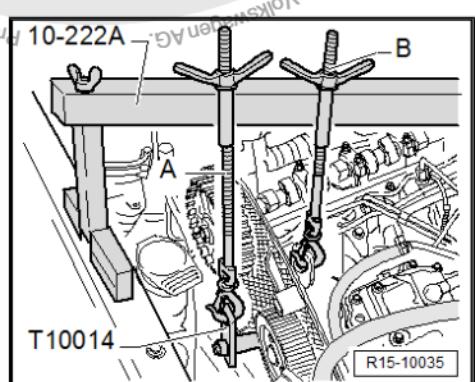
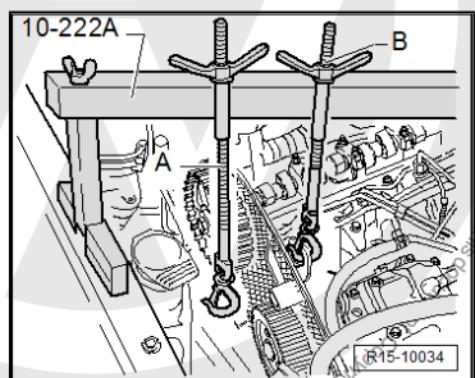
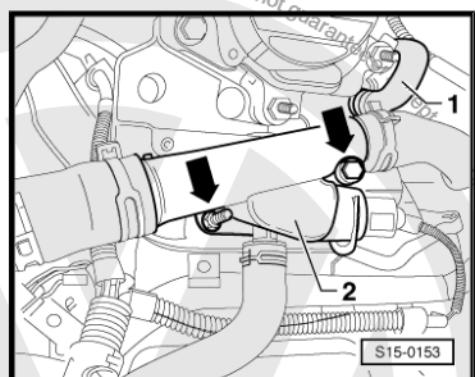
- Release the cooling system connection sleeve -2- -arrows- and take away the cooling system hose -1- in distribution part.
- Remove the upper mechanical distribution cover and cylinder head cover.
- Remove the vacuum pump of the brake servo.
- Install Support or VW 061 - 10-222A- and secure engine with the support spindle -B- in installation position.



Note

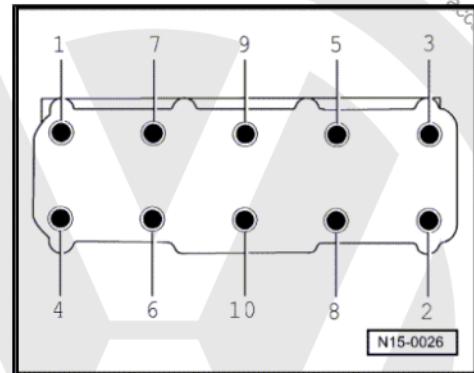
Both suspension supports are in the cylinder head, so another support must be placed to support engine on block.

- Remove the Poly-V belt [page 15](#) .
- Remove toothed belt from camshaft gear [page 36](#) .
- Remove engine support on the cylinder block [page 36](#) .
- Install the Support - T 10014- on front hole of the engine support above the water pump.
- With the second spindle, -A- raise the engine until releasing the spindle -B-.
- Remove the toothed belt tensioning roller.
- Remove mechanical distribution cover bolts behind the cylinder head.





- Loosen and remove the bolts from cylinder head in the indicated order.
- Remove the engine cylinder head carefully.



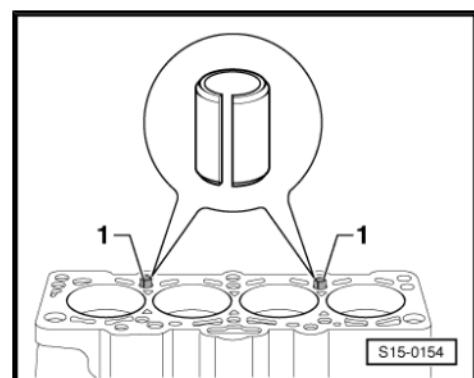
1.2.3 Installation



Note

- ◆ Always replace the securing bolts of the cylinder head.
- ◆ In case of repair, carefully remove the gasket remains between cylinder head and engine block. Be careful not to produce scratches. When using sandpaper, granulation may never be under 100
- ◆ Carefully remove sanding residues.
- ◆ Remove the new engine cylinder head sealing gasket from the package only immediately before installation.
- ◆ Handle the new gasket as carefully as possible. Damages in the groove area result into leaking.

- Stuff the cylinders with clean cloths to prevent dirt or residues from entering the area between inner cylinder walls and pistons.
- Also prevent dirt and residues from entering into the cooling system.
- Carefully remove sanding residues and remove the cloths.
- Check if the two adjustment guides -1- for alignment of cylinder head are installed.
- Before installing the cylinder head, put the crankshaft in TDC.
- Turn the crankshaft anticlockwise until all pistons are in TDC.
- Install cylinder head gasket.
- Install cylinder head and the other cylinder head bolts, and tighten them by hand.



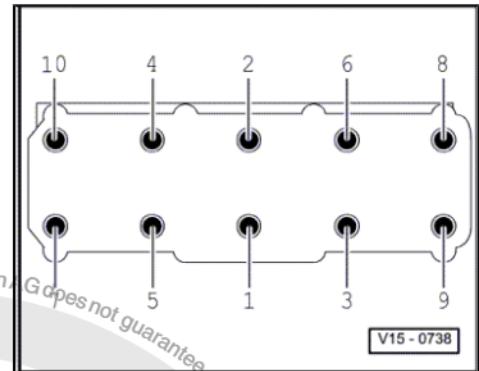


- Tighten the cylinder head bolts in four stages, following the sequence:
- 1. Prior tightening with torque: Pitch I = 40 Nm Pitch II = 60 Nm
- 2. Apply angular torque with spanner: Pitch III = 90° Pitch IV = 90°



Note

Bolts on the cylinder head do not need to be re-tightened after repairs.



Install in reverse order to the removal.

- After fastening the cylinder head, turn the camshaft so that the cams of cylinder 1 point upwards. Before installing toothed belt, put the camshaft to TDC to the direction of engine rotation.
- Install the camshaft gear with the toothed belt and fasten them with the securing bolt (the camshaft gear still remains mobile).

With toothed belt installed and ignition timing adjusted
[⇒ page 36](#).

- Install engine support block [⇒ page 36](#). Torque: 45 Nm.



Note

Before installing the assembly mounting, all bolts supporting the engine must have been tightened to the specified tightening torque.

- Install vacuum pump.
- Remove the front section of exhaust tube with catalytic converter [⇒ page 113](#).

Replenish the cooling system with new coolant [⇒ page 75](#).

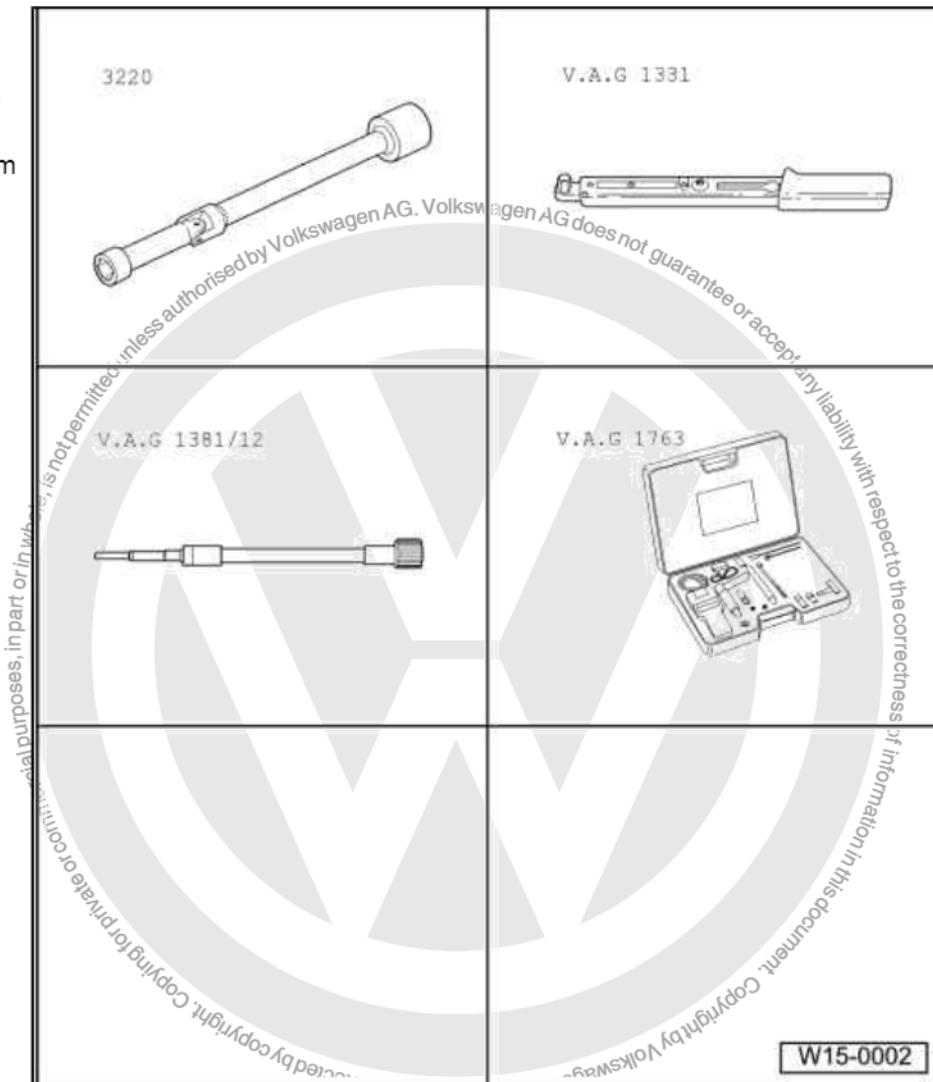
- Perform test run and check event memory [⇒ page 110](#).

1.3 Compression - check



Special tools and workshop equipment required

- ◆ U/J extension and socket, 10 mm - 3220-
- ◆ Torque wrench - 5 to 50Nm (enc. 1/2") - VAG 1331-
- ◆ Adaptor for VAG 1763 - VAG 1381/12-
- ◆ Cylinder compression gauge - petrol/ethanol - VAG 1763-

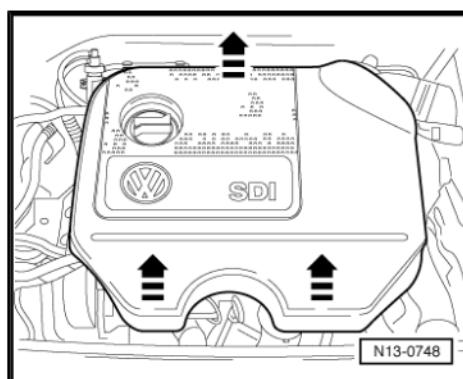


1.3.1 Checking conditions

- Minimum oil temperature 30 °C.

1.3.2 Checking sequence

- Remove the engine cover, -arrows-
- Disconnect the 10-pole connector to injection pump.
- Remove all glow plugs with U/J extension and socket 10 mm - 3220- .



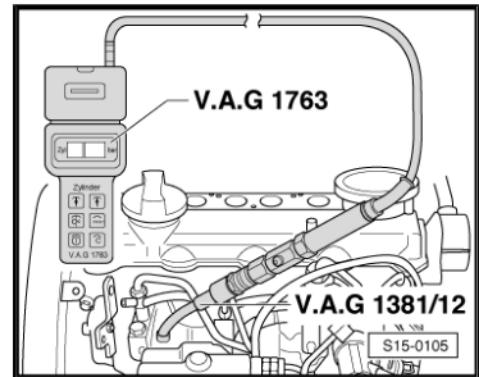


- Screw Adapter for VAG 1763 - VAG 1381/12- in place of the plugs.
- Check compression with the compression check device - V.A.G 1381- .



Use of check device ⇒ Instructions of use with equipment.

- Engage the starter until the check device stops indicating an increase in pressure.



Compression values:

Engine prefix	ASY
Cylinder compression	bar 25.0 to 31.0
Wear limit	bar 19,0
Maximum compression difference between cylinders	bar 5,0

- Install the glow plugs with U/J extension and socket 10 mm - 3220- . Tightening torque: 15 Nm.
- Perform test run and check event memory [⇒ page 110](#) .



Separation of connections to injection pump cause faults that are stored in the event memory. Due to this, check the event memory and erase if necessary.



2 Valve command - repair

Note

- ◆ Cylinder heads with cracks between the valve seats can still be used without reducing the useful life, provided that such cracks are small, maximum 0.5 mm wide.
- ◆ Lubricate all supporting and sliding surfaces prior assembly.

1 - Bearing covers

- Installation position
⇒ [page 51](#)
- Follow the sequence for removal and installation
⇒ [page 56](#).
- Apply Sealing paste - AMV 174 004 01- over the base surface of bearing cap.

2 - 20 Nm

3 - Camshaft

- Check axial clearance
⇒ [page 19](#)
- Remove and install
⇒ [page 56](#).
- Check radial clearance with "Plastigage": Wear limit: 0.11 mm.
- Eccentricity: max. 0.05 mm.
- Distribution times for 1-mm valve clearance
⇒ [page 52](#)

4 - Hydraulic tappet

- Before installation, check the axial clearance of the camshaft
⇒ [page 19](#)
- Check ⇒ [page 59](#).
- Do not change position.
- With valve clearance hydraulic offsetting.
- Upon removal, support with the upper section turned downwards.
- Lubricate contact surfaces.

5 - Keys

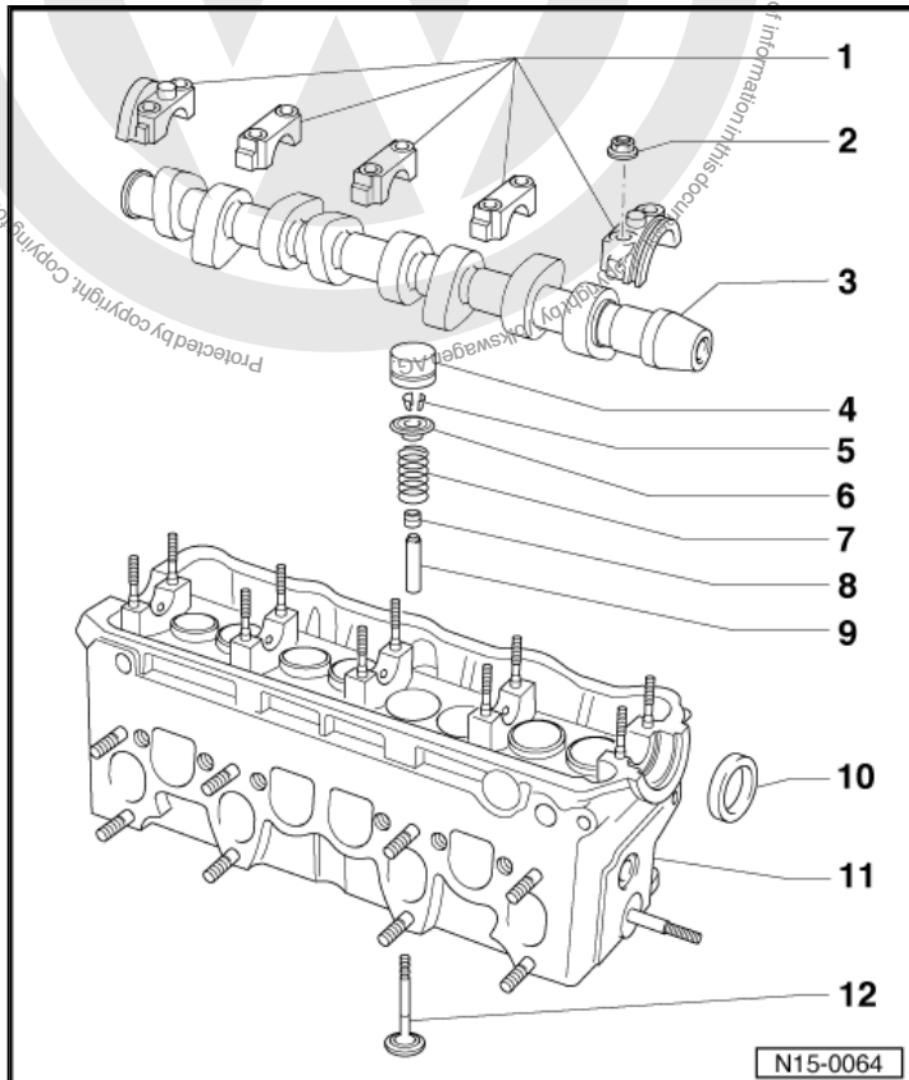
6 - Spring dish

7 - Valve spring

- Cylinder head - remove and install Remove with Compression device - 2037- assembled:
⇒ [page 54](#).

8 - Valve stem sealant

- Replace ⇒ [page 54](#).





9 - Valve guide

- Check [page 54](#).

10 - Seal

- Do not lubricate or grease the seal lip.
- Remove and install, adjust toothed belt [page 36](#).
- Before installation, remove oil residues from crank web with a clean cloth.
- For installation of the slot in the camshaft cone, seal with common adhesive tape.

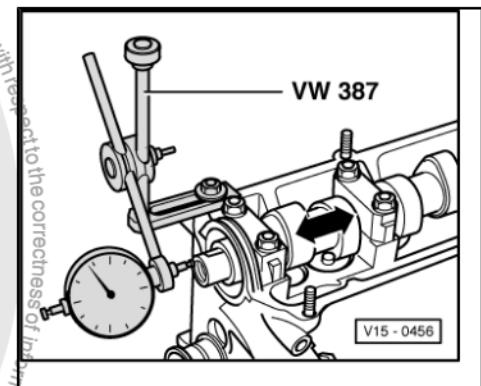
11 - Engine cylinder head

- Pay attention to the note [page 50](#).
- Grind valve seats [page 52](#).

12 - Valves

- Valve measurements [page 52](#)
- Do not grind, may be seated only.

Camshaft - check axial clearance



Special tools and workshop equipment required

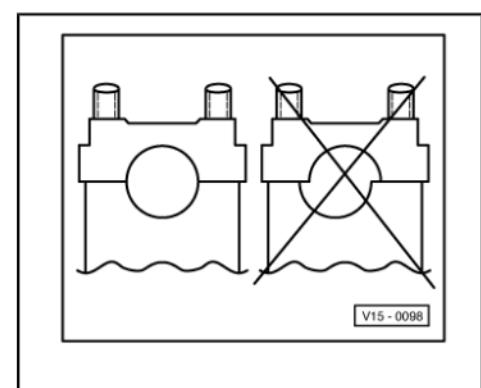
- ◆ Support - VW 387-
- ◆ Dial gauge

Perform the measurement with tappets removed and first and last bearing covers installed.

Wear limit: max. 0.15 mm

Installation position for camshaft bearing cover

Check runout. Before installing the camshaft, place the caps and determine the location of installation.





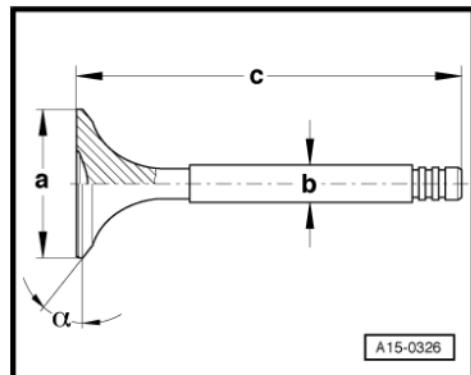
Valve dimensions



Note

Valves cannot be ground. Only seating is allowed.

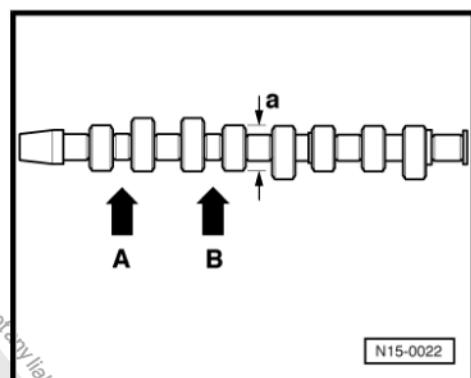
measurement	Intake valve	Exhaust valve
Ø a m m	35,95	31,45
Ø b m m	6,963	6,943
C m m	96,55	96,35
α °	45	45



Camshaft code

Identification:

- ◆ Cam base circles $a = \varnothing 38$ mm.
- ◆ Identified by letters and numbers engraved between admission and exhaust cams:



Cylinder 1 -arrow A-	38 E
Cylinder 2 -arrow A-	FL

Distribution times for 1mm of valve clearance

Intake opens after TDC	11,0° 12'
Intake closes after BDC	25°
Exhaust opens before BDC	40°
Exhaust closes before TDC	10°

2.1 Valve seat - trim

Special tools and workshop equipment required

- ◆ Depth pachymeter
- ◆ Valve seat grinder



Note

- ◆ Valves should not be grinded. Only seating is allowed.
- ◆ When repairing engines with leaky valves, grinding and/or replacing valves and valve seats is not enough. Especially for engines with greater mileage, valve guides should be checked for wear.
- ◆ Grind valve seats only until reaching perfect finishing. Before grinding, calculate the maximum grinding measure admissible. If the grinding measure is surpassed, hydraulic valve clearance compensation is no longer secured, and the cylinder head will have to be replaced.

2.1.1 Operation sequence

2.1.2 Calculating maximum trim:

- Install valve and firmly press it against the valve seat.



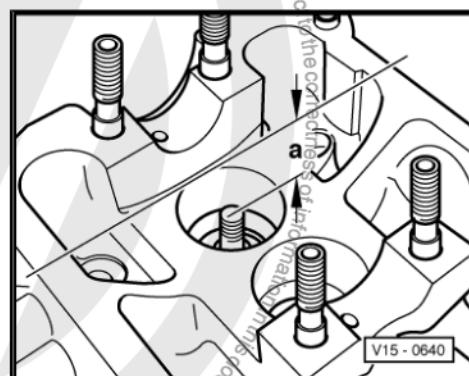
Note

If the valve is replaced during repairs, use a new valve to measure.

- Measure the distance -a- between the valve stem final end and the upper edge of the cylinder head.
- Calculate the maximum grind measure admissible as from distance measured -a- and the minimum measure.

Minimum measures Inlet valve = 35.8 mm. Exhaust valve = 36.1 mm.

Measure distance -a- minus minimum measure = maximum grind measure admissible.



2.1.3 For example:

-	Measured distance	36,5 mm
-	Minimum specification	35,8 mm
=	Max. grinding specification allowed	0,7 mm

2.1.4 Grind inlet valve seat

a = $\varnothing 35.7$ mm

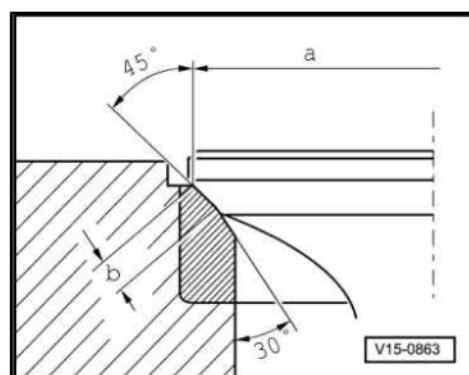
b = 1.6 mm

45° = valve seat angle.



Note

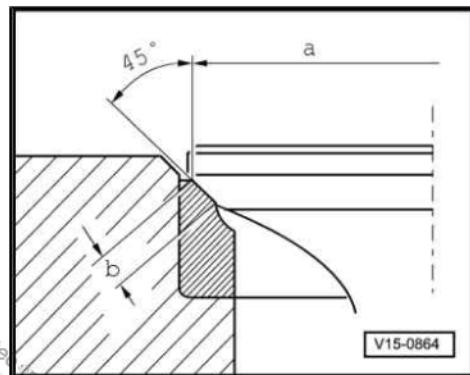
30° lowering by milling is strictly necessary due to the hydrodynamic conditions in intake channel.





2.1.5 Grind exhaust valve seat

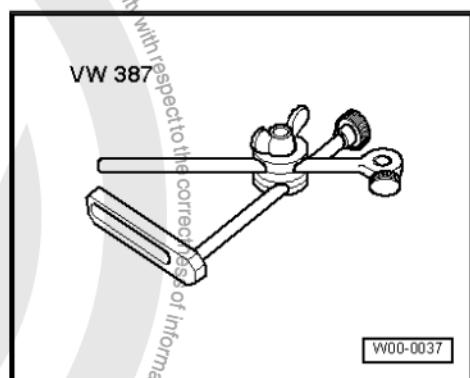
a = $\varnothing 31.4$ mm
b = 2.7 mm
45° = valve seat angle.



2.2 Valve guides - check

Special tools and workshop equipment required

- ◆ Support - VW 387-



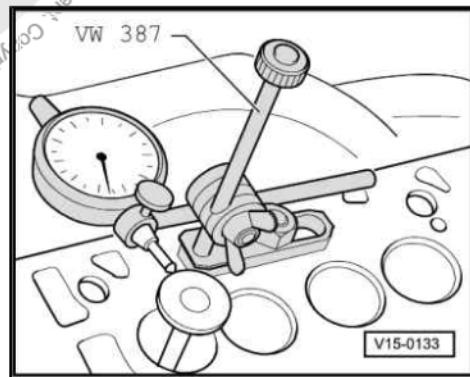
- ◆ Dial gauge

2.2.1 Checking sequence

- Place a new valve on the guide. The end of the valve should be aligned with guide. Due to the various valve guide diameters, it is recommended that only one intake valve be used on the intake guide and one exhaust valve on the escape guide.
- Measure tilting gap. Wear limit: 1.3 mm.

If the tilting clearance is exceeded:

- Replace engine cylinder head.

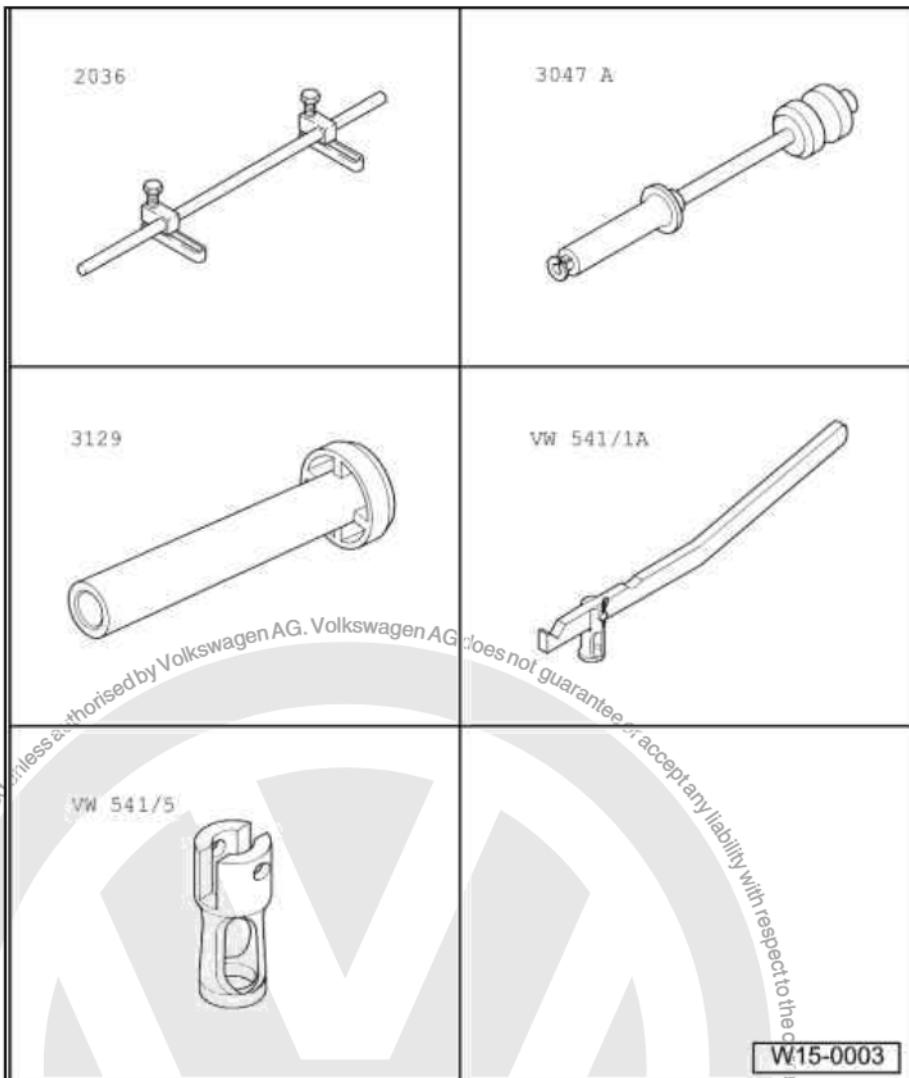


2.3 Valve rod sealant - replacement



Special tools and workshop equipment required

- ◆ Device - 2036-
- ◆ Puller or VW 5058 - 3047A-
- ◆ Fitter - 3129-
- ◆ Lever - VW 541/1A-
- ◆ Compressor - VW 541/50-



2.3.1 Removal

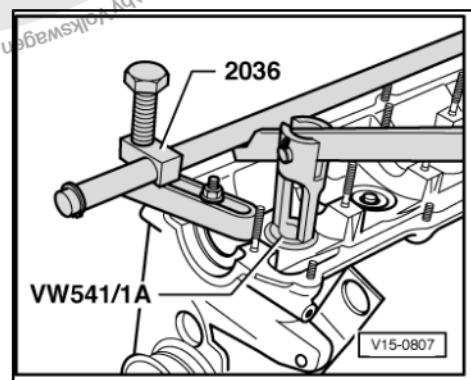
(with the cylinder head installed)

- Remove camshaft [⇒ page 56](#).
- Remove hydraulic tappets and place them with contact surface downwards. Make sure not to change the tappets' position.
- Place the piston of respective cylinder to "Top Dead Centre" (OT).
- Install the Device - 2036- and adjust bearings to the height of stud bolts.
- Remove valve springs with the Lever - VW 541/1A- and Compressor - VW 541/50-.



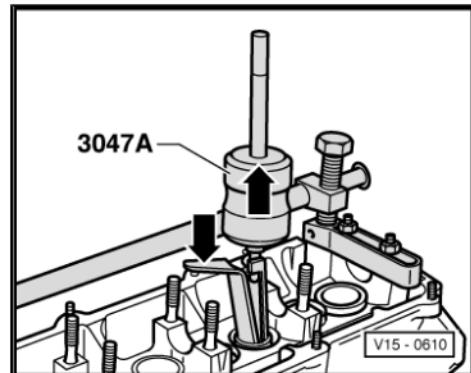
Note

The valves sit on the piston head.



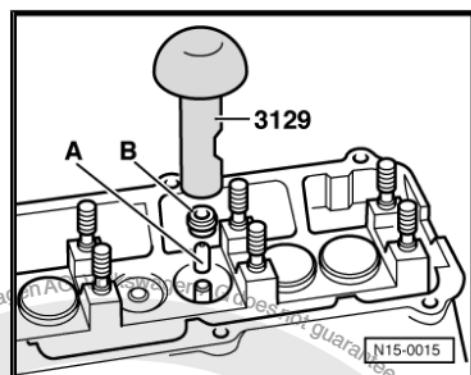


- Remove the valve stem seals with the Puller or VW 5058 - 3047A- .



2.3.2 Installation

- The supplied plastic sleeve -A- must be fitted to the respective valve stem. This avoids damages to the new valve stem seal -B-.
- Install the new valve stem oil seal with the Fitter - 3129- .
- Lubricate the sealing lip of oil stem seal and install carefully onto guide.



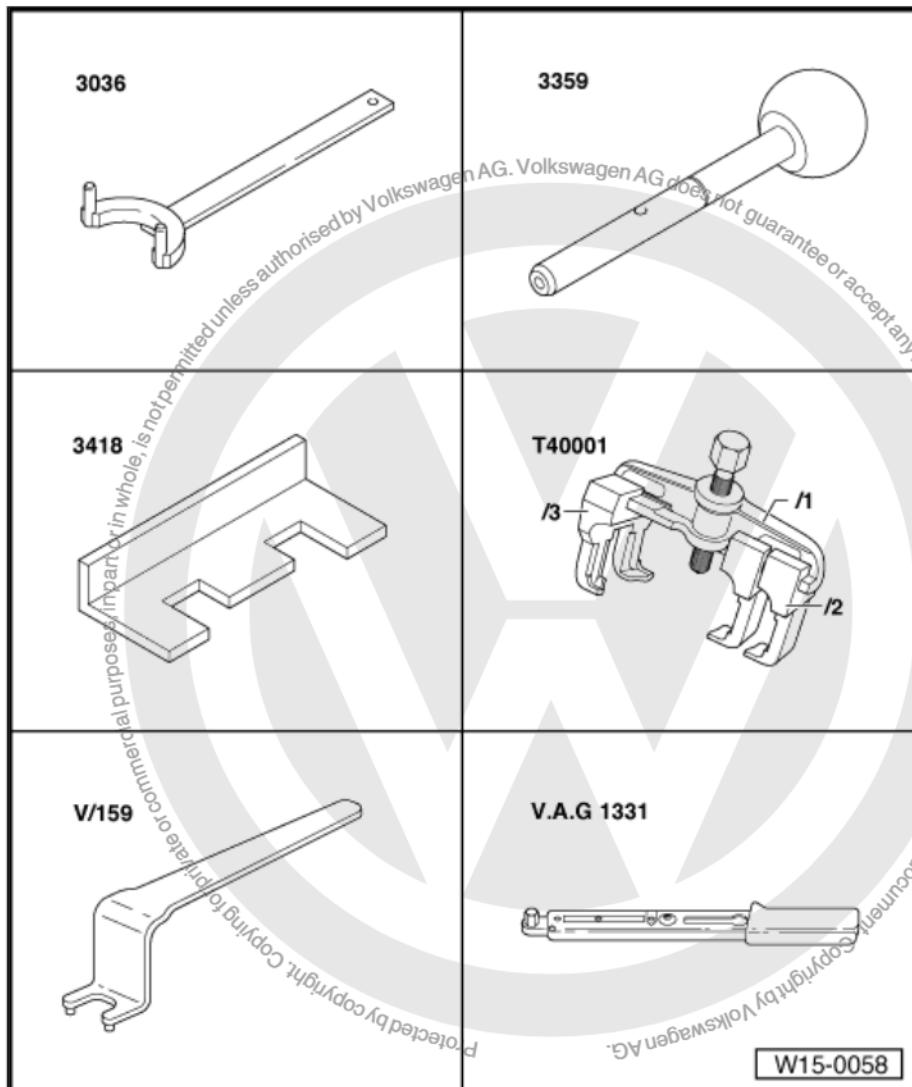
2.4 Camshaft - remove and install

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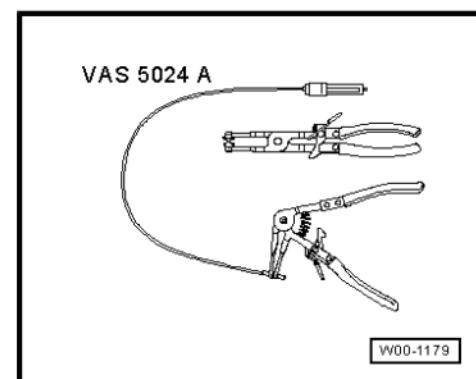


Special tools and workshop equipment required

- ◆ Special wrench - 3036-
- ◆ Lock pin - 3359-
- ◆ Alignment rod - 3418- or Alignment rod - T 10098A-
- ◆ Puller - T 40001-
- ◆ Key - V 159-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-



- ◆ VW 5162 or Standard type clamp pliers - VAS 5024A-



- ◆ Feeler gauge
- ◆ Sealing compound - AMV 174 004 01-

2.4.1 Removal

- Remove the top cover of the mechanical distribution, the cylinder head cover and vacuum pump.
- Remove toothed belt from camshaft gear [page 36](#).



Note

It is not necessary to remove the pulley/vibration damper of the camshaft, nor the intermediate and lower cover of mechanical distribution.

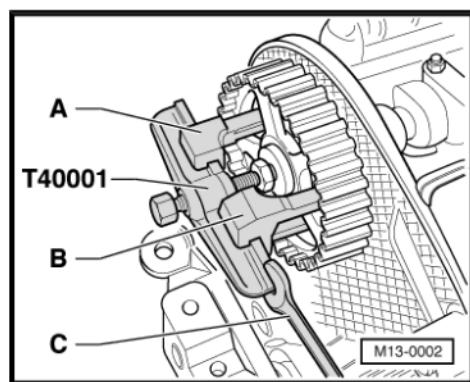
- Loosen the camshaft gear bolt with one turn. To loosen the screw, immobilize the camshaft gear with a Special wrench - 3036- .



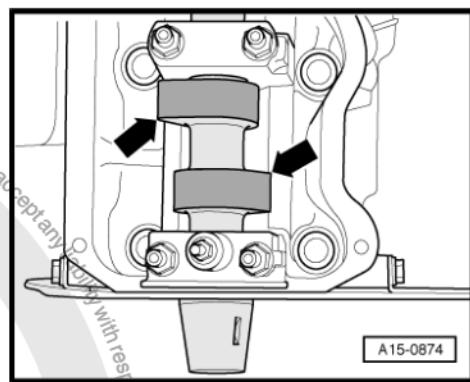
Note

To loosen and tighten the camshaft gear, never use the Alignment rod - 3418- or Alignment rod - T 10098A- for immobilization! Use the Pin wrench - 3036- .

- Place the Puller - T 40001- with the one-arm claw - T40001/2- -A- and Two-arm claw - T40001/3- -B- centred over the cam-shaft gear, and remove the gear. Use a spanner -C- as a support.
- Remove the camshaft gear.
- First remove covers of bearings 5, 1, and 3. Loosen bearing covers 2 and 4 in cross pattern.



2.4.2 Installation

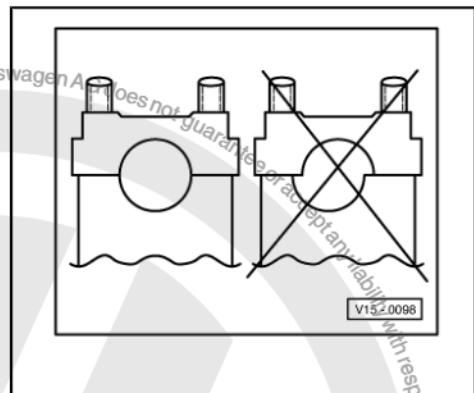




Note

- ◆ When installing the camshaft, valve cams for the cylinder 1 should point upward.
- ◆ When installing bearing covers, pay attention to the hole run-out, before install, place the bearing cover and check the correct installation position.

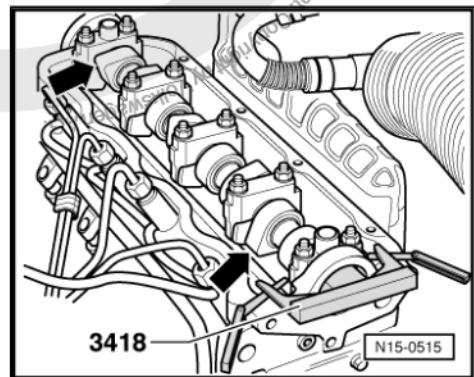
- Lubricate the camshaft contact surfaces.
- Place camshaft over cylinder head.
- Tighten bearing covers 2 and 4 in cross pattern to 20 Nm.
- Apply a thin coat of Sealing paste - AMV 174 004 01- over the base surface of bearing covers 1 and 5.
- Install the covers of bearings 5, 1 and 3, and tighten the nuts to 20 Nm.



Note

Remove the excess of Sealing paste - AMV 174 004 01- from bearing covers 1 and 5 on cylinder head. There must be no Sealing paste - AMV 174 004 01- on the sealing surface of cylinder head/head cover.

- Lock the camshaft as shown with the Alignment rod - 3418- .
- Distribute the Alignment rod - 3418- average as follows: Turn the camshaft so that one end of the Alignment bar - 3418- touches the cylinder head. At the other end of Alignment rod - 3418- , measure clearance with a feeler gauge. Place the gauge with half of the clearance measure found between Alignment rod - 3418- and cylinder head. Turn the camshaft until the Alignment rod - 3418- touches the gauge. Insert another feeler gauge with same measurement in the other end between Alignment rod - 3418- and cylinder head.



Note

The camshaft can also be locked with the Alignment rod - T 10098A- .

With toothed belt installed and ignition timing adjusted
[⇒ page 36](#) .

- Install the top cover of the mechanical distribution, the cylinder head cover and vacuum pump.



Note

After installing new hydraulic tappets, the engine cannot be started for approx. 30 minutes. Hydraulic compensation elements must seat (otherwise the valves will hit the pistons).

2.5 Hydraulic tappets - check

Special tools and workshop equipment required

- ◆ Feeler gauge



- ♦ Wood and/or plastic wedge



Note

- ♦ Replace hydraulic tappets completely (they cannot be adjusted nor disassembled).
- ♦ The irregular noise coming from the valves at start up is normal.

2.5.1 Checking conditions

- Minimum oil temperature 80 °C.

2.5.2 Checking sequence

- Start the engine and let it work until the Radiator blower - V7-functions once.
- Raise the revs to 2500 rpm during 2 minutes.

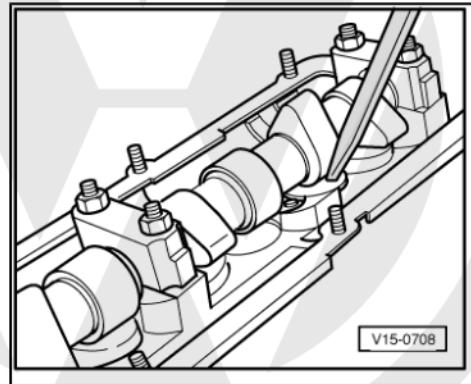
If the hydraulic tappets continue producing noise, determine the faulty tappet as follows:

- Remove the cylinder head cover.
- Turn the crankshaft clockwise until the tappet cams to be verified point upwards.
- Determine the clearance between the cams and tappets.
- If the clearance is greater than 0.10 mm, replace the tappet. If clearance is less than 0,10 mm or no clearance is detected, proceed with checking as follows:
- Slightly press tappet down with a plastic and/or wood wedge. If it is possible to insert a 0,10 feeler gauge between crankshaft and tappet, replace the tappet.



Note

After installing new hydraulic tappets, the engine cannot be started for approx. 30 minutes. Hydraulic compensation elements must seat (otherwise the valves will hit the pistons).





17 – Lubrication

1 Lubrication system components - remove and install



Note

- ◆ Carefully clean the oil ducts and replace the oil filter if significant amounts of metal particles are found in the oil during engine service due to abrasion or wear resulting from seizure (for instance, from the connecting rods or bearing shells). To prevent damage, clean oil passages carefully, and replace oil filter and oil radiator.
- ◆ Oil level should not exceed the Max. marking due to the risk of damage to the catalytic converter!



WARNING

Always replace self-locking nuts and screws subject to angular torque

Check oil pressure [⇒ page 68](#).

Oil filling quantities:

with a 4.3-litre oil filter

Engine oil specification:

Only use engine oils as per norm -VW 505 00- or -VW 505 01- .

Part I - assembly overview

Part II - Oil filter and support - disassemble and assemble
[⇒ page 61](#) .



1 - 15 Nm

2 - Crankshaft flange (pulley side)

- With sealant.
- With Silicone sealant for engine - D 176 404 A2 ou A3- [page 22](#) .
- Remove and install [page 22](#) .
- Do not lubricate or grease the seal lip.
- Before installation, remove oil residues from crankshaft journal with a clean cloth.
- Replace crankshaft seal (pulley side) [page 20](#) .

3 - Chain tensioner with tensioning guide, 15 Nm

- Press spring to install.

4 - Gear

- To activate the oil pump.

5 - oil dipstick

- Oil level shall not exceed the max. mark. !
- Mark [page 63](#)

6 - Funnel

- Remove to aspirate oil.

7 - Guide tube

8 - Oil ejector

- For piston cooling.

9 - 25 Nm

- Install without sealant.

10 - Sealing ring

- Replace.

11 - Adjustment guide

12 - Suction tube

- Clean screen filter, if dirty.

13 - Noise buffer

14 - Crankcase

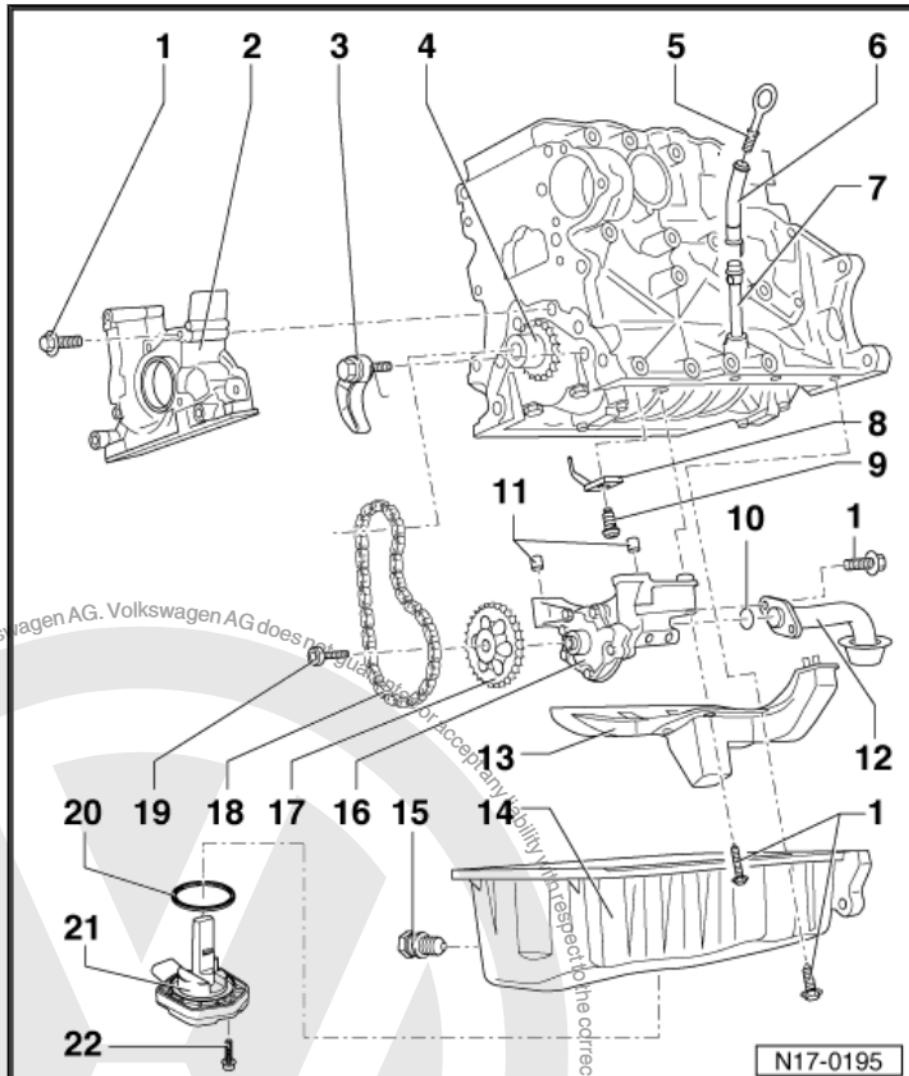
- Clean the sealing surfaces before installation.
- Remove and install [page 65](#) .

15 - Oil draining plug, 30 Nm

- In case of leak, cut the sealing ring and replace, otherwise, replace the plug.

16 - Oil pump

- With 12 bar overpressure valve.
- Before installation, check if the two adjustment sleeves for centralization are positioned (oil pump / engine block).
- Replace if there is formation of cracks or any other damages.
- Remove and install [page 67](#) .





17 - Chain gear for oil pump

- Pay attention to the correct assembly position.
- Fitted only in one position.

18 - Chain

19 - 20 Nm 90°

- Replace after each removal.

20 - Sealing ring

- Replace.

21 - Oil level and temperature sensor - G266-

- Not available.

22 - 10 Nm

Marks on oil dipstick

1 - Max. mark

2 - Min. marks

a - Region between the upper corner of the engraved region and the max. mark: do not refill with oil.

b - Marked area oil level: May be refilled with oil.

c - Region between min. mark and area below the marked region: Refill with up to 0.5 litre of engine oil.

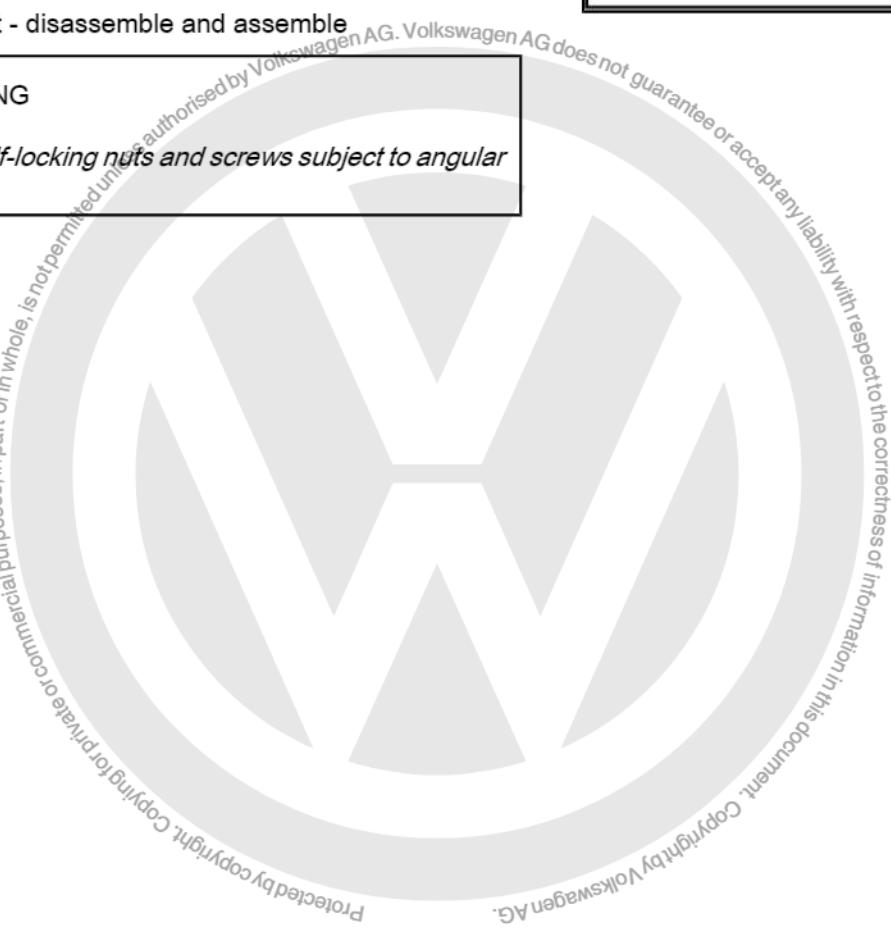
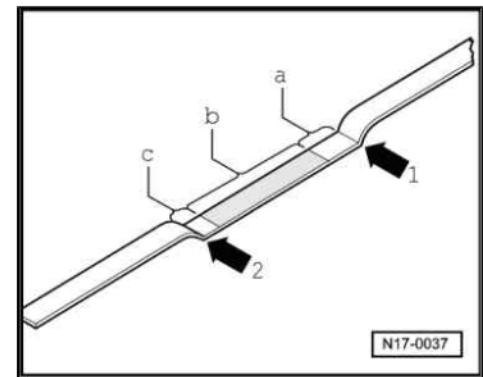
Part II

Oil filter and support - disassemble and assemble



WARNING

Always replace self-locking nuts and screws subject to angular torque





1 - Oil filter bracket

2 - 15 Nm 90°

- Replace after each removal.
- First lean the upper left and lower right bolts, after that, tighten the four bolts in cross pattern.

3 - Gasket

- Replace.

4 - Sealing ring

- Replace.

5 - Plug, 25 Nm

- Do not release.

6 - Plug, 25 Nm

7 - Sealing ring

- Replace.

8 - Oil filter element

- Check installation position: top = on top.

9 - Sealing ring

- Replace.

10 - Drain plug, 25 Nm

11 - Gasket

- Replace.

12 - Oil radiator

- Check for mobility in relation to adjacent components.

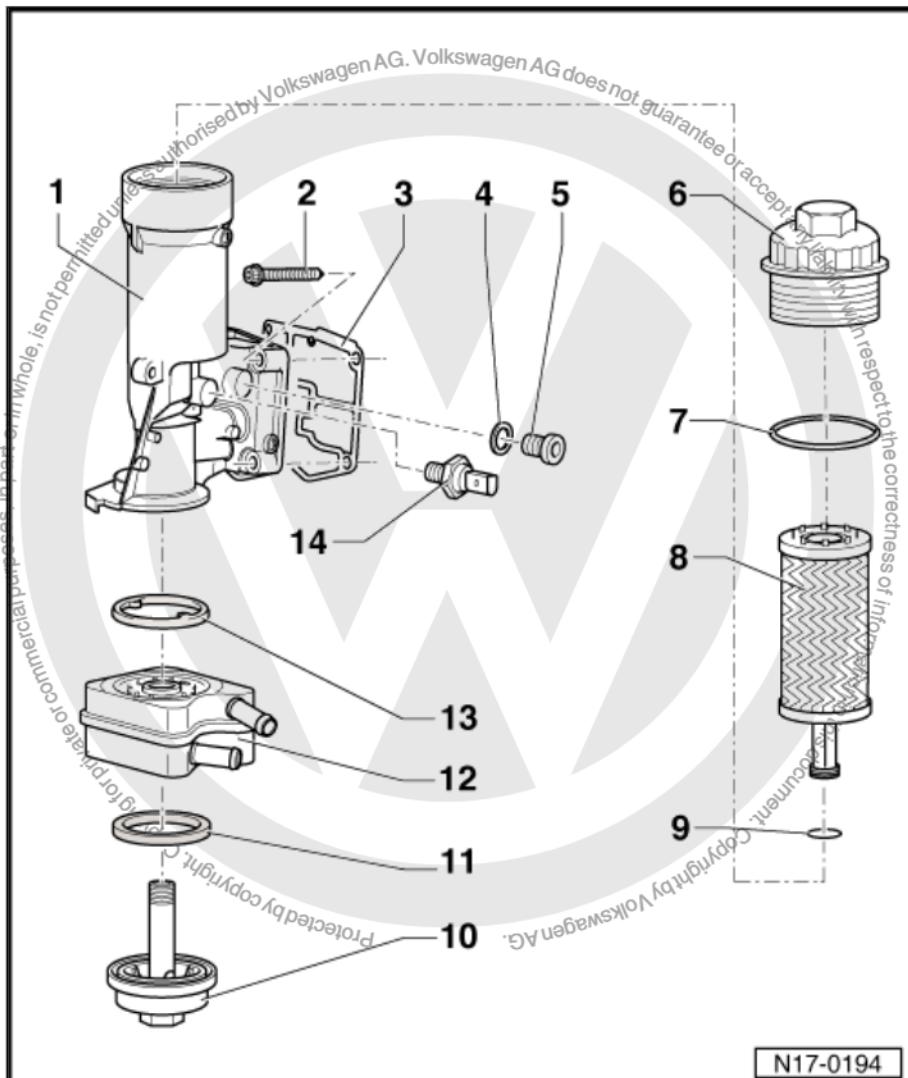
Pay attention to the note [⇒ page 61](#).

13 - Sealing ring

- Replace.

14 - Oil pressure switch - F1- , 20 Nm

- 0.55 to 0.85 bar : brown.
- Tightening torque 17...23 Nm.
- In case of leakage, cut and replace the sealing ring.
- Check [⇒ page 68](#).

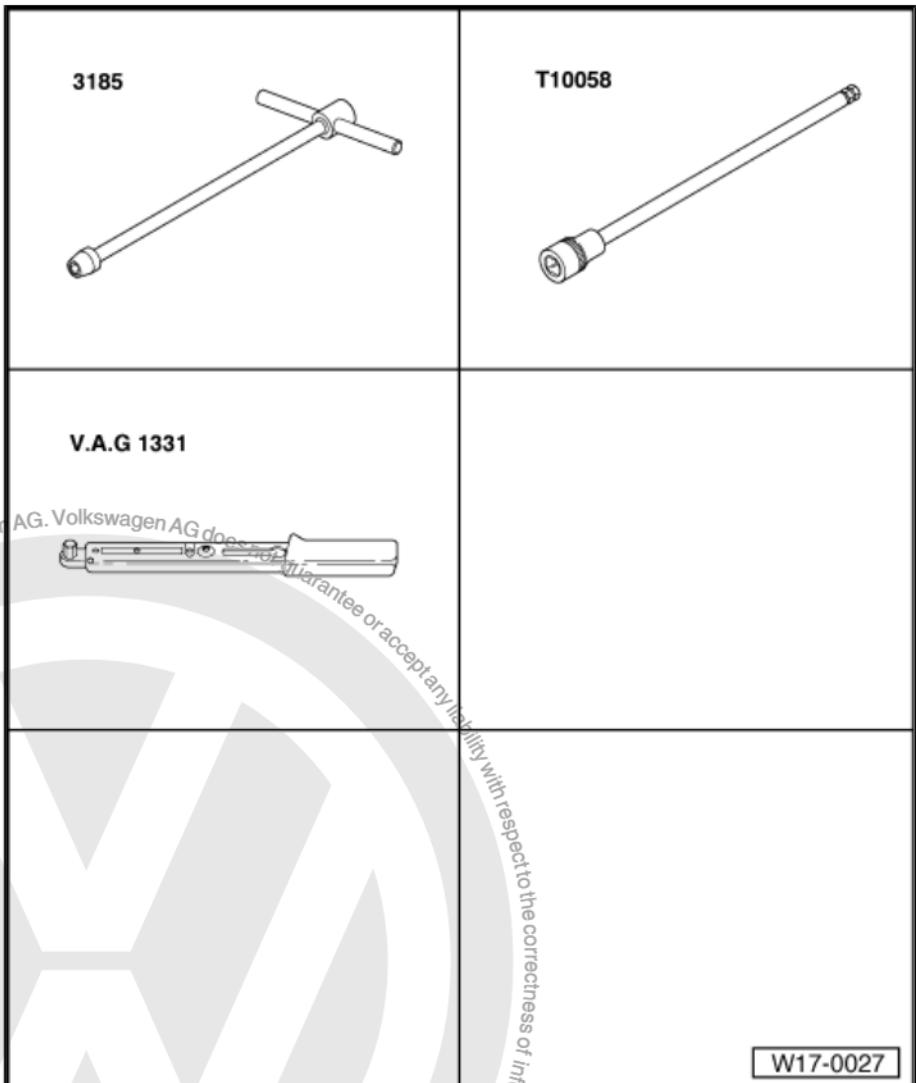




1.1 Crankcase - remove and install

Special tools and workshop equipment required

- ◆ Articulated Wrench 10 mm - 3185-
- ◆ Socket - T 10058-
- ◆ Torque wrench - 5 to 50Nm (enc. 1/2") - VAG 1331-
- ◆ Flat scraper
- ◆ Drilling machine with plastic brush
- ◆ Silicone sealant for engines - D 176 404 A2-





1.1.1 Removal

- Remove the noise insulation from the engine.
- Drain engine oil.



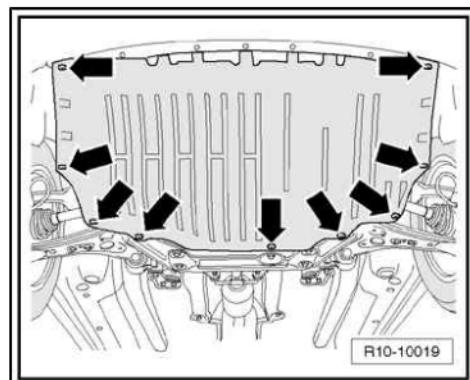
Observe the disposal norms!

- Release the crankcase .



Remove bolts by flywheel side with the Articulated wrench 10 mm - 3185- and Socket - T 10058- .

- Remove crankcase by slightly tapping with a rubber hammer.
- With the scraper, remove residues of Engine silicone sealant - D 176 404 A2 ou A3- that may be still in cylinder block.
- Eliminate residues of Engine silicone sealant - D 176 404 A2 ou A3- from the crankcase with a rotary brush, like a plastic brush attached to a portable drill (wear goggles).
- Clean the sealing surfaces. They must be free of oil and grease.

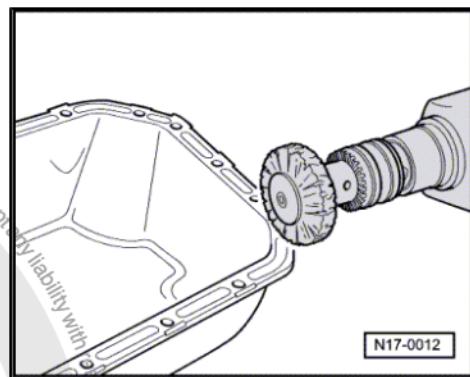


R10-10019



WARNING

Wear protective goggles



N17-0012

1.1.2 Installation



Note

- ◆ *Observe the expiration date of the Engine silicone sealant - D 176 404 A2 ou A3- .*
- ◆ *The oil crankcase must be installed within 5 minutes of applying the Engine silicone sealant - D 176 404 A2 ou A3- .*
- ◆ *The crankcase may be easily and safely installed by putting threaded pins M6 in two points of the cylinder block flange.*

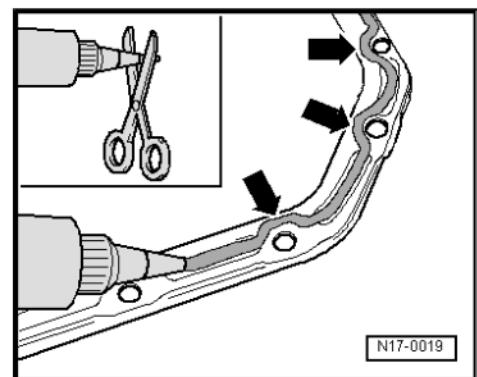


- Cut the pipe applicator on front marking (\varnothing of ejector is approx. 3 mm).
- Apply the Engine silicone sealant - D 176 404 A2 ou A3- as shown, onto clean crankcase sealing surface. The sealing cord should:
 - ◆ be 2 to 3 mm thick.
 - ◆ Pass through the inner bolt segments-arrows-.



Note

The sealing cord cannot be thicker, in order to avoid the excess of Engine silicone sealant - D 176 404 A2 ou A3- from entering the crankcase and clog the screen filter of the oil suction tube.



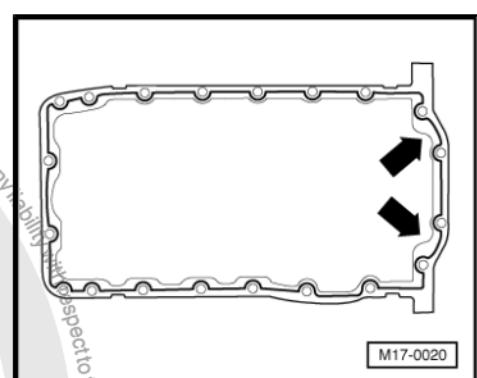
N17-0019

- The Engine silicone sealant - D 176 404 A2 ou A3-, as shown in figure, should be applied onto the cleaned crankcase sealing surface. (Figure shows a cord of Engine silicone sealant - D 176 404 A2 ou A3- on engine block)
- Place immediately the crankcase and insert all bolts without a slight torque.



Note

Install bolts at flywheel side with Socket - T 10058- and tighten with Articulated wrench 10 mm - 3185- .



M17-0020

Tighten crankcase/gearbox bolts to 15 Nm in cross pattern.

Tighten crankcase/gearbox screws to 45 Nm.



Note

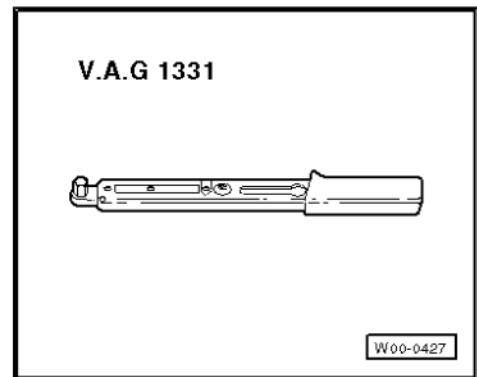
After installing the crankcase, the Engine silicone sealant - D 176 404 A2 ou A3- must dry for approx. 30 minutes. Replenish with engine oil only after this period has elapsed.

Install in reverse order to the removal.

1.2 Oil pump - remove and install

Special tools and workshop equipment required

- ◆ "Torque wrench - 5 to 50 Nm (enc. 1/2")" - VAG 1331-



V.A.G 1331



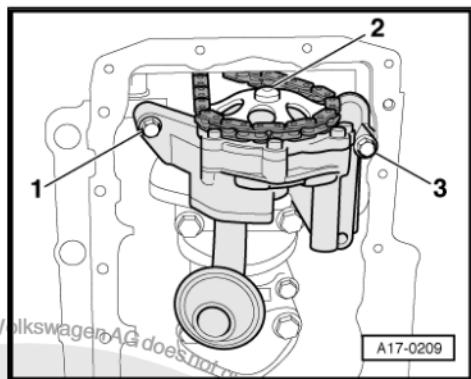
W00-0427

1.2.1 Removal

- Remove the crankcase [page 65](#) .



- Remove the bolt -2-.
- Remove bolts -1- and -3-.
- Remove oil pump.



1.2.2 Installation

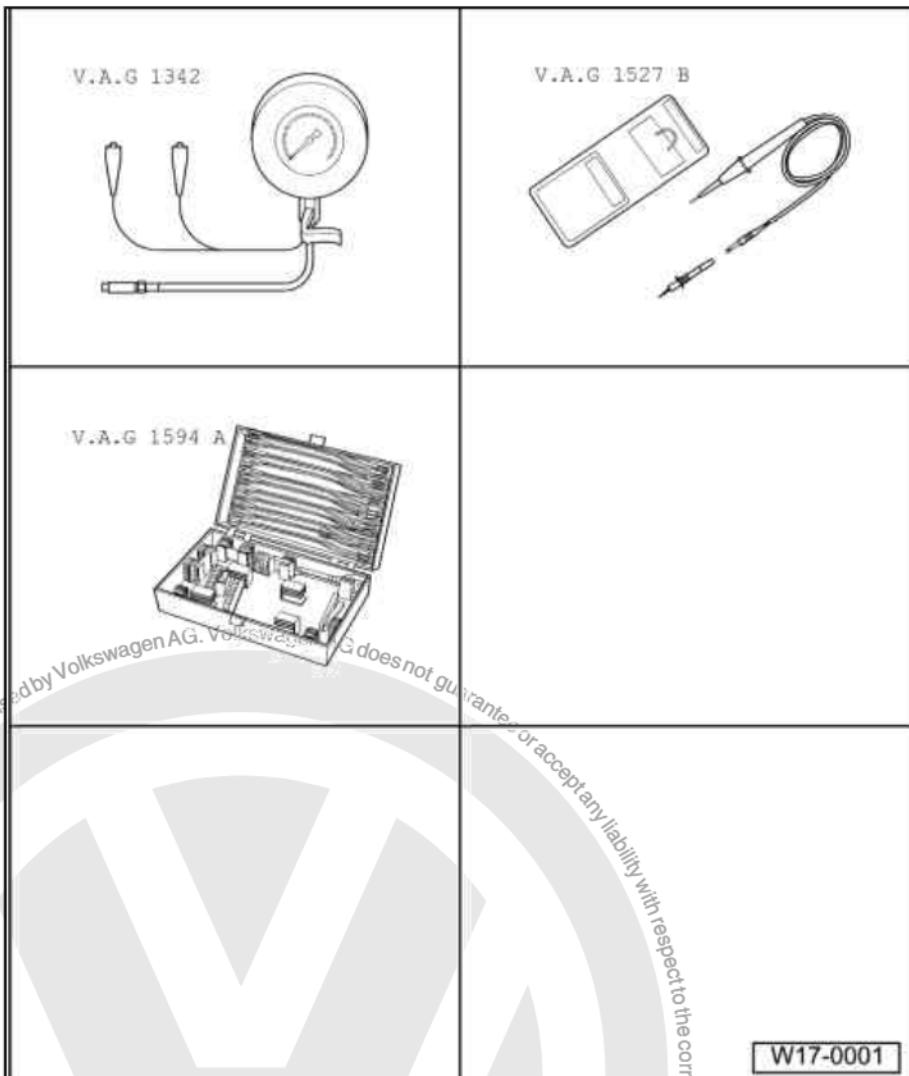
- Installation is performed in reverse sequence to the removal, considering the following:
- Install adjustment guides onto the upper section of oil pump.
- Pump/gear installation position: only one assembly position.
- Pay attention to the installation position of gear on pump.
- Tighten the new chain gear bolt to 20 Nm + 90°.

1.3 Oil pressure and Oil pressure switch - F1- - check



Special tools and workshop equipment required

- ◆ Oil pressure gauge - VAG 1342-
- ◆ Test probe or VAG 1527B - EQ 7300-
- ◆ Auxiliary measuring cable set - VAG 1594C-



W17-0001

1.3.1 Oil pressure warning dynamic indication - functions

The Oil pressure switch - F1- opens without pressure and closes when reaching the switching pressure.

The Oil pressure warning is activated approx. 10 seconds after the ignition is turned on.

Activation time of oil pressure warning approx. 3 seconds.

Deactivation time of oil pressure warning approx. 5 seconds.

1.3.2 Check indicator light

With ignition on and engine off, the oil pressure control light on instrument case must turn on for approx. 3 seconds, then turn off again. Checking stops with engine functioning.

1.3.3 Warning criteria

The optical oil pressure warning (intermittent signal of oil pressure control lamp) and a buzzer sound alert occur in one of the following conditions.

- “Ignition on”, engine off, oil switch closed.
- Engine speed higher than 1500 rpm, oil switch open.



Note

- ◆ When engine speed is higher than 5000 rpm, the control light remains on, even with switch. The light turns off again when engine speed drops under 5000 rpm.
- ◆ If the oil pressure switch, at engine speed higher than 1500 rpm, is open during only 0,3 ... 3,0 seconds, this is stored into the combined processor in instrument case. If this situation repeats three times during engine functioning, the oil pressure warning triggers immediately and does not turn off at an engine speed under 1500 rpm. The oil pressure alarm is cancelled when the oil pressure switch remains closed for more than 5 seconds above 1500 rpm or when the ignition is turned off.

1.3.4 Checking conditions

- Oil level OK, check [⇒ page 63](#)
- The Oil pressure control light - K3- must turn on during 3 seconds with ignition on.
- Engine oil temperature, at least 80°C (the Radiator blower - V7- must have been activated at least once).

1.3.5 Checking sequence

- Remove Oil pressure switch - F1- -A- and install onto Oil pressure gauge - VAG 1342- .
- Install the Oil pressure meter - VAG 1342- in place of the Oil pressure switch - F1- on oil filter support.
- Connect brown cable from the Oil pressure gauge - VAG 1342- to the ground (-).
- Couple the Test probe - VAG 1527B- with Auxiliary measuring cable set - VAG 1594C- to the positive terminal of the Battery - A- (+) and to the Oil pressure switch - F1- -B-.

The LED should not light up.

- If the LED does light up, replace the Oil pressure switch - F1- .

If the LED does not light up:

- Start the engine and let it run at a higher speed. Between 0.55... 035-bar pressure, the LED must go on; otherwise, replace the Oil pressure switch - F1- .
- Continue increasing engine speed. At 2000 rpm and an oil temperature of 80°C, the oil pressure should be about 2.0 bar.

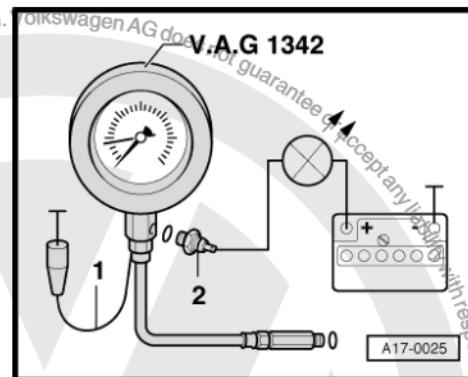
If the theoretical values are not reached:

- Mechanical damage, e.g., eliminate bearing damages.
- Replace the oil filter support with oil overpressure valve or the oil pump.

At higher speed, the oil pressure cannot be higher than 7,0 Bar.

If the theoretical value is surpassed:

- Check oil lines.
- If necessary, replace oil filter support with overpressure valve.





19 – Cooling

1 Cooling system components - remove and install



WARNING

In all installation works, especially in engine compartment, due to lack of space, pay attention to the following:

- ◆ All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling system and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.
- ◆ Allow easy access to all the moving or hot parts.



Note

- ◆ The cooling system is under pressure when the engine is hot. Thus, it is necessary to reduce the pressure before conducting repairs.
- ◆ Hose connection are fastened by spring clamps. For repairs, use spring clamps only.
- ◆ To install spring clamps, we recommend using the Standard-type clamp pliers - VW 5162- or Standard-type clamp pliers - VAS 5024A- or Clamp pliers - VAG 1921- .
- ◆ The cooling system hoses should be installed without tension and without coming into contact with other components (observe the marks on the cooling system connection on the hose).

Check the cooling system leaks with the Engine cooling system tester - VAG 1274- or Engine cooling system tester - VAG 1274B- and the Adapter for VAG 1274 - VAG 1274/8- and the Adapter for VAG 1274 - VAG 1274/8- .

Cooling system components, body side [⇒ page 71](#) .

Cooling system components, engine side [⇒ page 73](#) .

Cooling system hoses connection diagram [⇒ page 74](#) .

Drain and replenish the cooling system [⇒ page 75](#) .

Coolant preparation instructions [⇒ page 75](#) .

1.1 Cooling system components, body .



1 - Radiator

- Remove and install
[⇒ page 80](#).
- After replacement,
change all coolant.

2 - Sealing ring

- Replace.

3 - Upper hose of the cooling system

- Fastened to the radiator with a clip.
- Make sure it is well fastened.
- Cooling system hoses connection diagram
[⇒ page 74](#).

4 - Lid

Check for cooling system leaks using the Engine cooling system tester - VAG 1274- or Engine cooling system tester - VAG 1274B- and the Adapter for VAG 1274 - VAG 1274/9- .

- Test pressure 1.4...1.6 bar.

5 - 5 Nm

6 - Coolant reservoir

Check for cooling system leaks using the Engine cooling system tester - VAG 1274- or Engine cooling system tester - VAG 1274B- and the Adapter for VAG 1274 - VAG 1274/8- .

7 - Support

- To the Radiator fan - V7- .
- Observe installation position.
- Observe various models.
- For the Radiator fan - V7- connector.

8 - 5 Nm

9 - Support

- Of the Radiator fan - V7- .

10 - 10 Nm

11 - Radiator fan - V7-

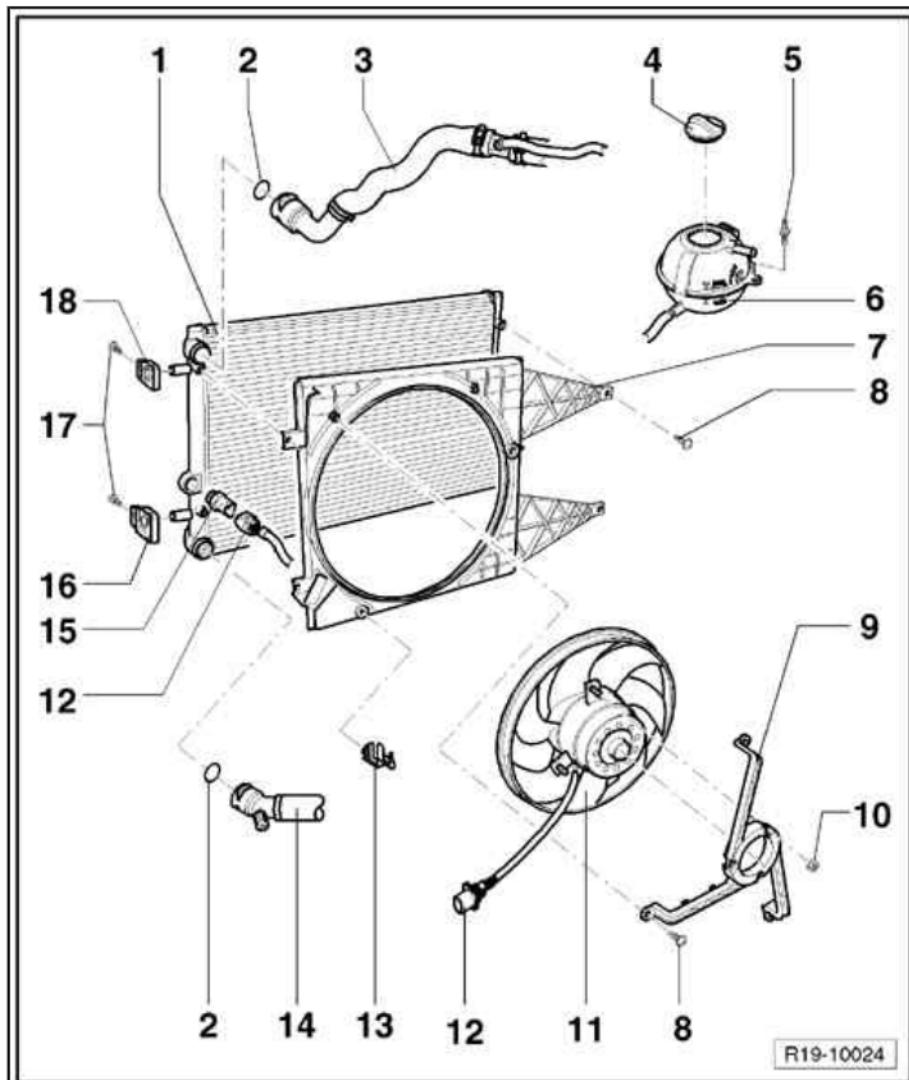
12 - Connector

13 - Support

- For the Radiator fan - V7- connector.

14 - Lower hose of the cooling system

- Fastened to the radiator with retaining clip.
- Make sure it is well fastened.
- Cooling system hose connection diagram [⇒ page 74](#).





15 - Radiator fan thermal switch - F18- , 35 Nm

- Of the Radiator fan - V7- .
- Drive temperatures: Stage 1 on: 92...97° C off: 84° C. Stage 2 on: 99...105° C off: 91° C.

16 - Radiator lower bearing

17 - 5 Nm

18 - Radiator upper support

- White.

1.2 Cooling system components, engine .

1 - Upper tube of the cooling system

- Bound to the intake manifold.

2 - 10 Nm

3 - Connection nozzle

- To heat exchanger.

4 - Connection nozzle

- In the cylinder head.

5 - Distribution part

6 - To the top of the radiator

- Cooling system hoses connection diagram [⇒ page 74](#) .

7 - 15 Nm

8 - Coolant temperature sensor - G62-

- For Engine control unit - J623- .
- Depressurize the system before removal.

9 - Clip

- Check fastening.

10 - Sealing ring

- Replace.

11 - Sealing ring

- Replace.

- Check fastening.

12 - Pipe of the cooling system

- Cooling system hoses connection diagram [⇒ page 74](#) .

13 - To the coolant expansion tank

- Cooling system hoses connection diagram [⇒ page 74](#) .

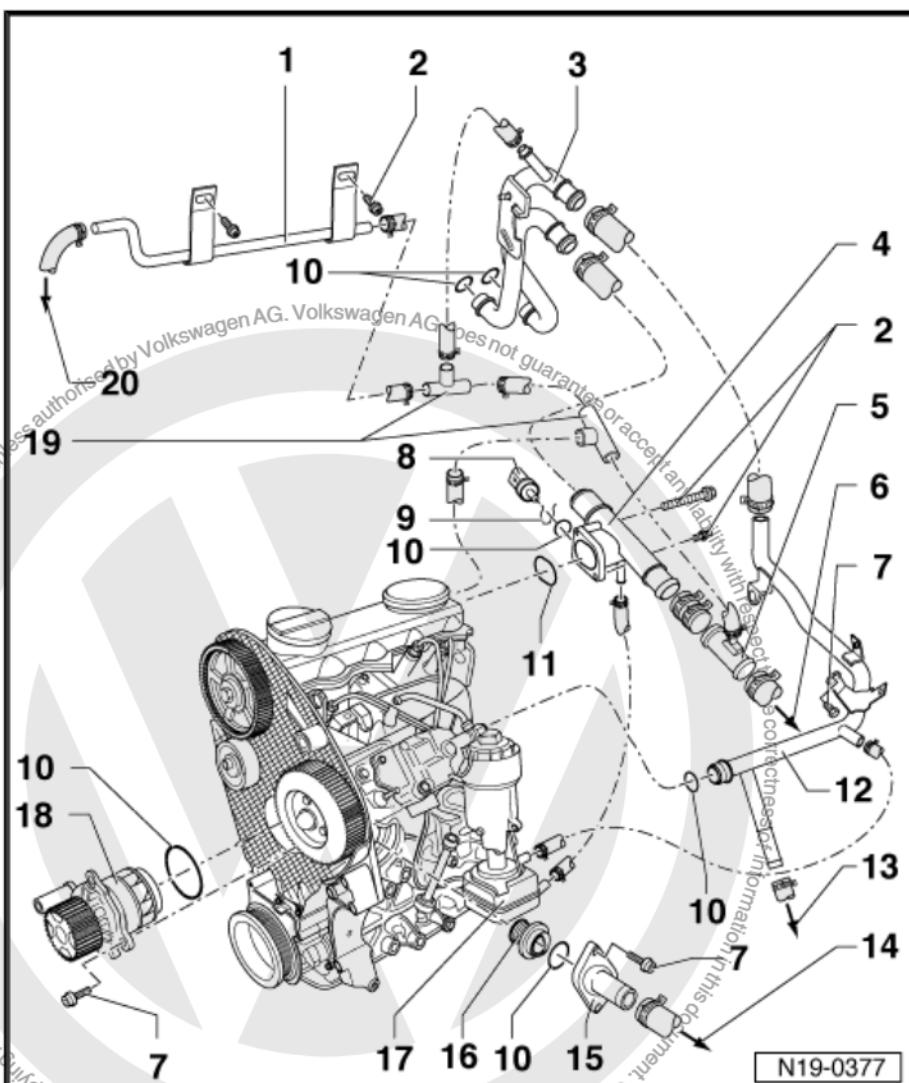
14 - To the bottom of the radiator

- Cooling system hoses connection diagram [⇒ page 74](#) .

15 - Thermostat valve flange

16 - Thermostatic valve

- Check: heat the thermostatic valve in simmering water.



N19-0377



- Opening start (approx. 87 °C).
- Opening route min. 7 mm with 99...105 °C.

17 - Oil radiator

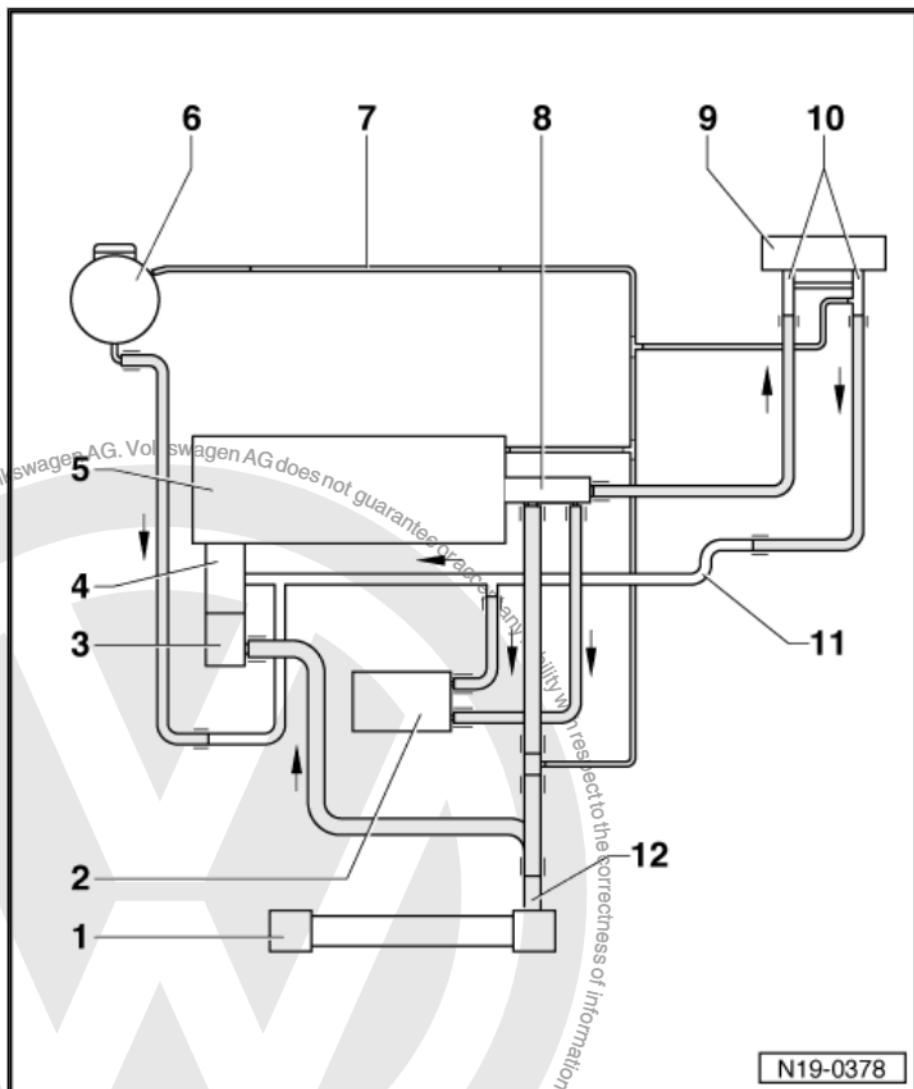
18 - Water pump

- Check mobility.
- In case of faults, replace completely.
- Remove and install [⇒ page 78](#).

19 - Distribution part

1.3 Cooling hose connection diagram .

- 1 - Radiator
- 2 - Oil radiator
- 3 - Cooling system thermostat valve
- 4 - Water pump
- 5 - Cylinder head/crankcase
- 6 - Coolant reservoir
- 7 - Upper tube of the cooling system
- 8 - Connection nozzle
- In the cylinder head.
- 9 - Heat exchanger for internal heating
- 10 - Connection nozzle
- To heat exchanger.
- 11 - Cooling system tube
- 12 - Quick coupling

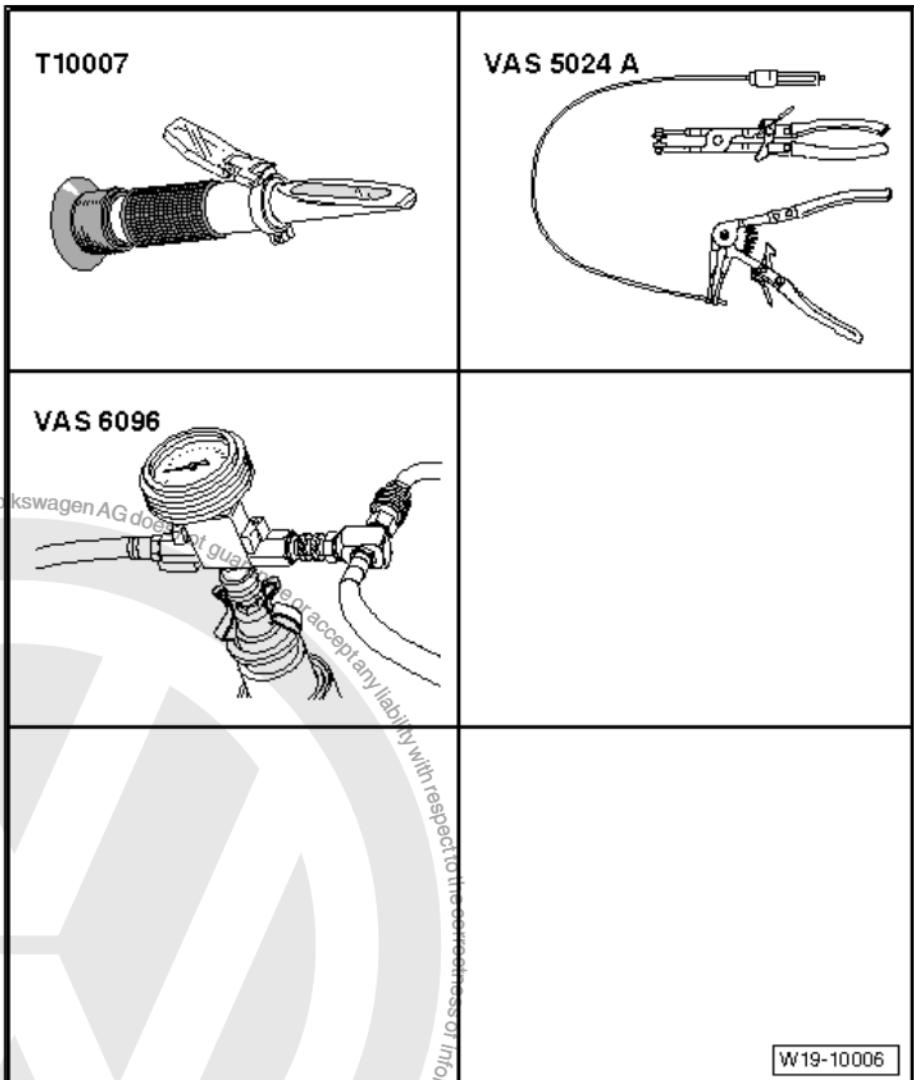




1.4 Cooling system - drain and fill

Special tools and workshop equipment required

- ◆ Refractometer - T10007A-
- ◆ Standard-type clamp pliers - VAS 5024A- or Standard-type clamp pliers - VW 5162-
- ◆ Oil trap - VAG 1306-
- ◆ Cooling system supply unit - VAS 6096-



1.4.1 Drain

- Remove coolant expansion tank lid.

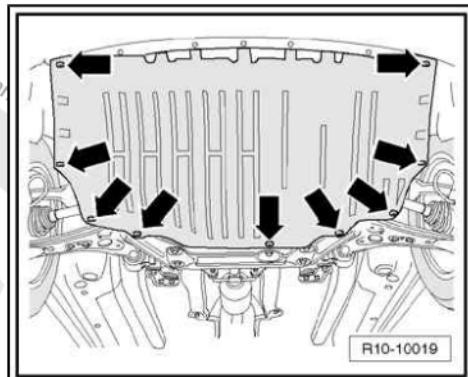


WARNING

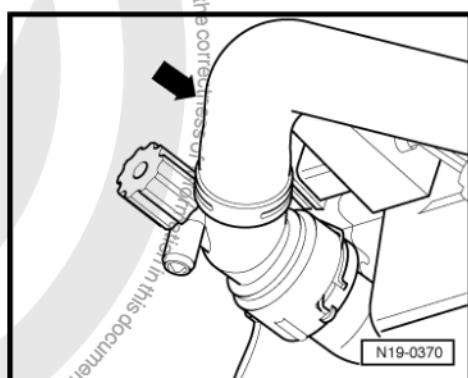
Hot vapours may escape when the coolant reservoir is opened; cover it with a cloth and open carefully.



- Remove the noise insulation from the engine.
- Drain cooling system [⇒ page 75](#).
- Remove engine lines with Standard-type clamp pliers - VW 5162 (VWB) - ou - VAS 5024A- .



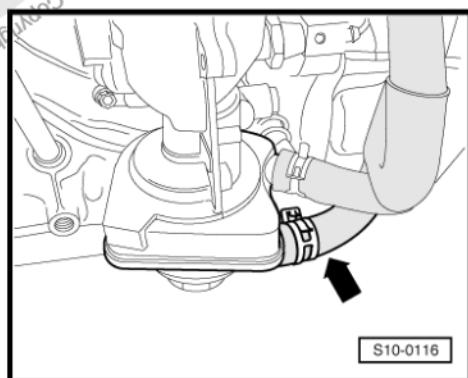
- Remove the lower line of the radiator -arrow-.



- To drain the cooling system, also disconnect the hose from the engine cooling system on the oil radiator -arrow-.



Observe the disposal norms for cooling fluids!





1.4.2 Replenishing



Note

- ◆ Only G13 antifreeze additive Coolant additive - G 013 A8J M1- is allowed, according to the TL 774 J standard. It is identified by colour red.
- ◆ Never mix, under any circumstances, G13 Coolant additive - G 013 A8J M1- with other antifreeze additives.
- ◆ If fluid in reservoir is brown, that indicates that G13 Coolant additive - G 013 A8J M1- has been mixed with other antifreeze. In that case, replace the coolant entirely.
- ◆ G13 Coolant additive - G 013 A8J M1- and antifreeze additives labelled "compliant with TL 774 J" prevent damages resulting from corrosion, freezing or formation of mould by further increasing the boiling temperature of the coolant. Therefore, the cooling system must always have the recommended mixture of antifreeze and anti-corrosion products.
- ◆ Due to the high boiling temperatures it provides, antifreeze is especially helpful in tropical countries, ensuring safe operation when the engine is submitted to heavy-duty work.
- ◆ Antifreeze protection must be assured to approximately -25 °C (in countries with arctic climates, to approximately -35 °C).
- ◆ Coolant concentration must not be diluted by adding water during hot seasons, or in countries with hot climates. The percentage of antifreeze should be at least 40 %.
- ◆ If the climate requires higher antifreeze protection, the percentage of G13 Coolant additive - G 013 A8J M1- may be increased, but only up to 60 % (antifreeze protection down to -40 °C). The higher proportion lowers cooling capacity and antifreeze protection.
- ◆ In order to determine the antifreeze protection density, use the Refractometer - T10007A- .
- ◆ Do not reuse old coolant when replacing the radiator, heat exchanger, cylinder head or cylinder head gasket.
- ◆ Use only clean drinkable water to prepare the coolant.

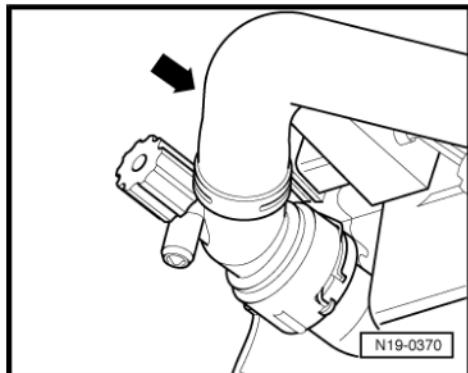
Recommended proportions:

Antifreeze protection up to	Antifreeze percentage	G 13 ⁴⁾	Water ⁴⁾
-25 °C	40 %	2.0 l	3.0 l
-35 °C	50 %	2.5 l	2.5 l

4) The amount of coolant may vary according to the vehicle's accessories.



- Install the lower line of the radiator -arrow-.

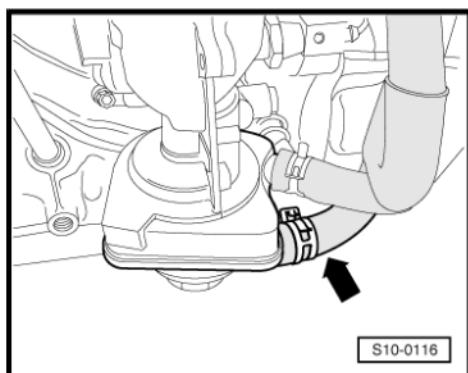


- Install the cooling line of the oil radiator -arrow-.

With Cooling system supply unit - VAS 6096-

- Install the Adaptor for VAG 1274 - VAG 1274/8- on the coolant tank suited for this vehicle.
- Fill the cooling system with the Cooling system supply unit - VAS 6096- ⇒ Operation instructions for the Cooling system supply unit - VAS 6096- .

Without Cooling system supply unit - VAS 6096-



- Fill with coolant up to the max. mark on the coolant tank.

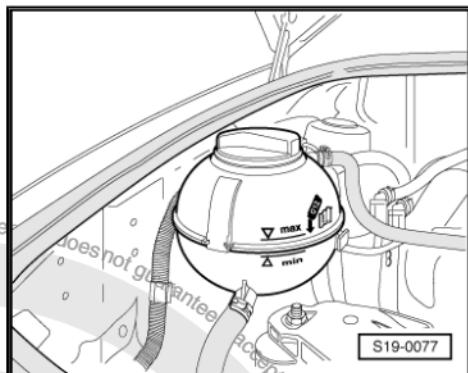
With or without Cooling system supply unit - VAS 6096-

- Start the engine and maintain a speed of about 2,000 rpm for approx. 3 minutes.
- Run the engine until the Radiator fan - V7- starts.



WARNING

Hot vapour may escape when the coolant tank is opened; cover it with a cloth and open carefully.



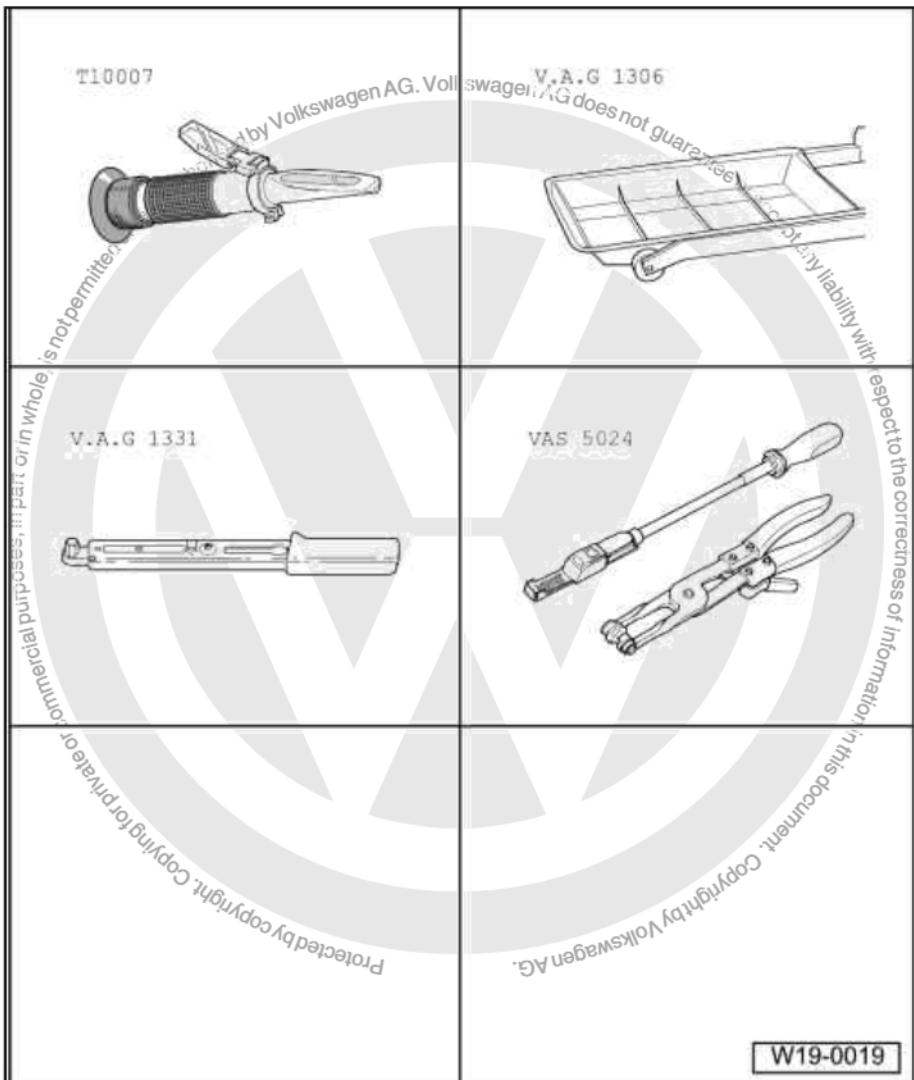
- Check coolant level and correct if necessary: While the engine is hot, the coolant level must reach the upper mark in the graduated area. While engine is cold, the coolant level must be at the middle of the graduation.

1.5 Water pump - remove and install



Special tools and workshop equipment required

- ◆ Refractometer - T10007A-
- ◆ Oil trap - VAG 1306-
- ◆ Torque wrench - 5 to 50Nm (enc. 1/2") - VAG 1331-
- ◆ Standard-type clamp pliers - VW 5162- or Standard-type clamp pliers - VAS 5024A- or Clamp pliers - VAG 1921-



W19-0019

1.5.1 Removal

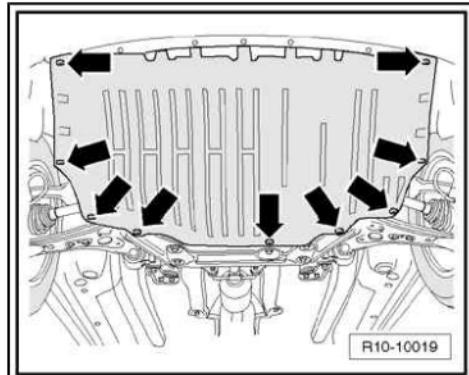


Note

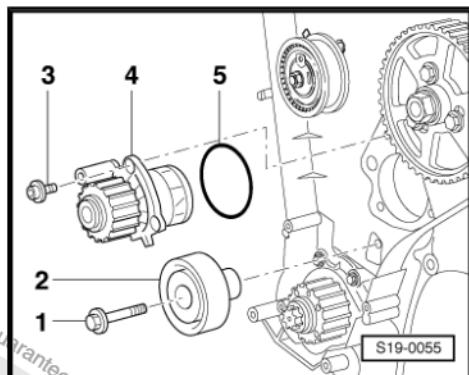
- ◆ Sealing gaskets and rings must be always replaced.
- ◆ Bottom cover of the mechanical distribution can remain installed.
- ◆ The toothed belt remains installed on the crankshaft cog.
- ◆ To protect toothed belt from coolant, cover it with a cloth before removing the water pump.



- Remove the noise insulation from the engine.
- Drain cooling system [⇒ page 75](#).
- Remove the Poly-V belt [⇒ page 15](#).
- Remove mechanical distribution upper and intermediate covers [⇒ page 11](#) and [⇒ page 36](#).
- Remove toothed belt from camshaft gear [⇒ page 36](#).



- Remove securing bolt -1- from pulley -2- and remove the pulley.
- Remove water pump -4-.



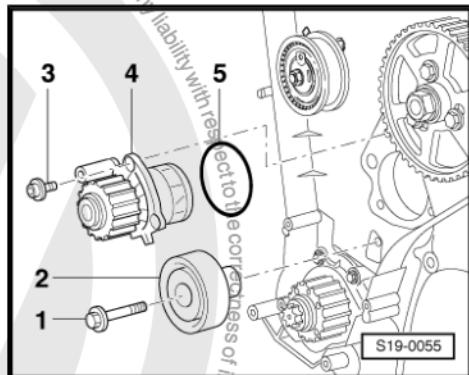
1.5.2 Installation

Install by inverting the removal sequence, paying attention to the following:

- Moisten the new sealing ring -5- with the coolant.
- Install the water pump on the engine block. Tightening torque: 15 Nm.
- Replace securing bolt -1- for pulley -2- and install the pulley. Tightening torque: 40 Nm + 90°.

Installing the toothed belt and adjusting distribution times
[⇒ page 36](#).

- Install Poly-V belt [⇒ page 15](#).
- Replenish cooling system [⇒ page 75](#).

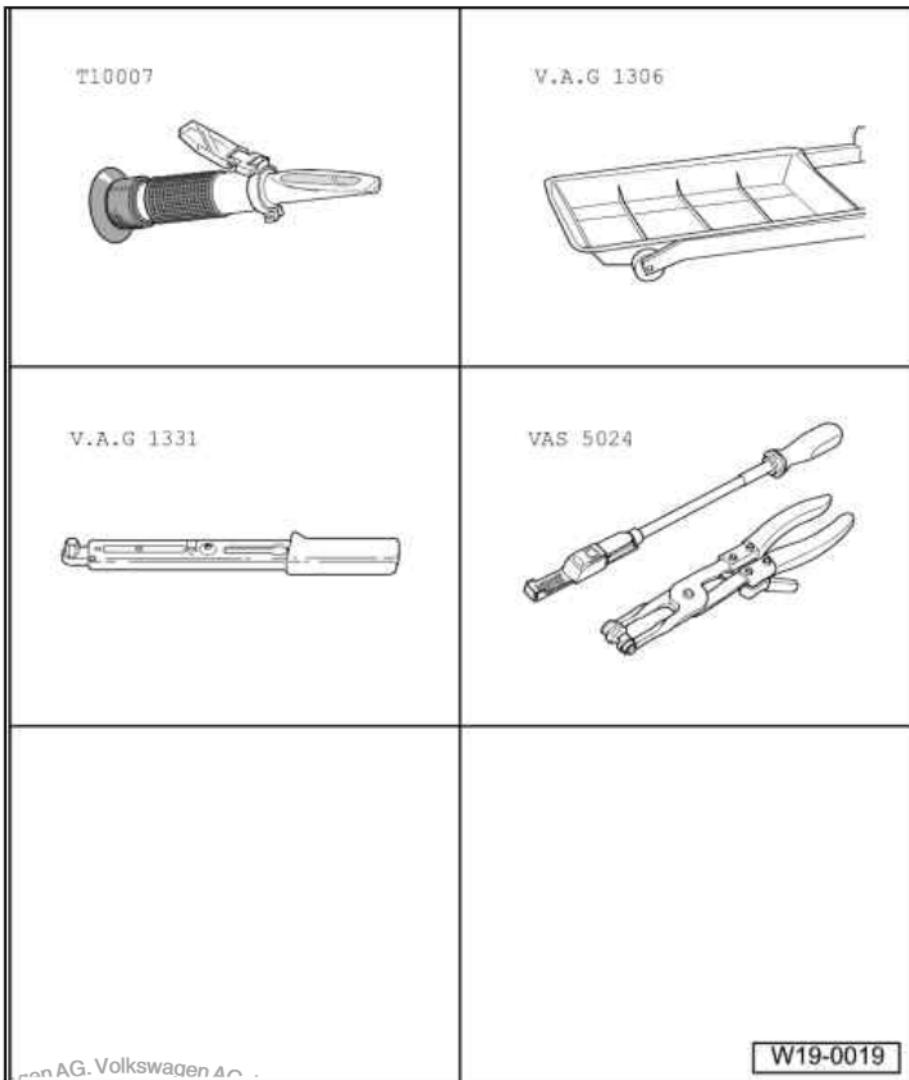


1.6 Radiator - remove and install



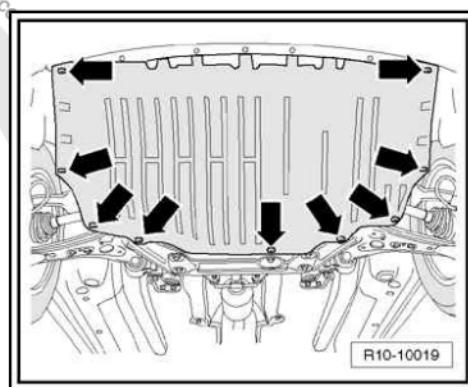
Special tools and workshop equipment required

- ◆ Refractometer - T10007A-
- ◆ Oil trap - VAG 1306-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-
- ◆ Standard-type clamp pliers - VW 5162- or Standard-type clamp pliers - VAS 5024A- or Clamp pliers - VAG 1921-



1.6.1 Removal

- Remove the noise insulation from the engine.
- Remove bumper cover ⇒ General body repairs, exterior; Rep. gr. 63; Bumpers .
- Remove the front end ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - Front section .
- Drain cooling system ⇒ [page 75](#) .
- Loosen quick couplings from the radiator cooling system.
- Disconnect the connector from the Radiator fan - V7- .
- Loosen the radiator fastening screws and remove the radiator with Radiator fan - V7- .



Vehicles with air conditioning

- Observe additional instructions and installation works ⇒ [page 82](#) .

1.6.2 Installation

Installation is carried out by inverting the removal sequence, observing the following:



- Replenish cooling system [⇒ page 75](#) .
- Install front end ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - Front section .
- Install bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumpers .

1.6.3 Additional notes and installation works in vehicles with air conditioning



WARNING

The air conditioning cooling gas loop should not be opened.



Note

To prevent faults in the cooling gas hoses and condenser, make sure the hoses are not stretched, bent or crushed.

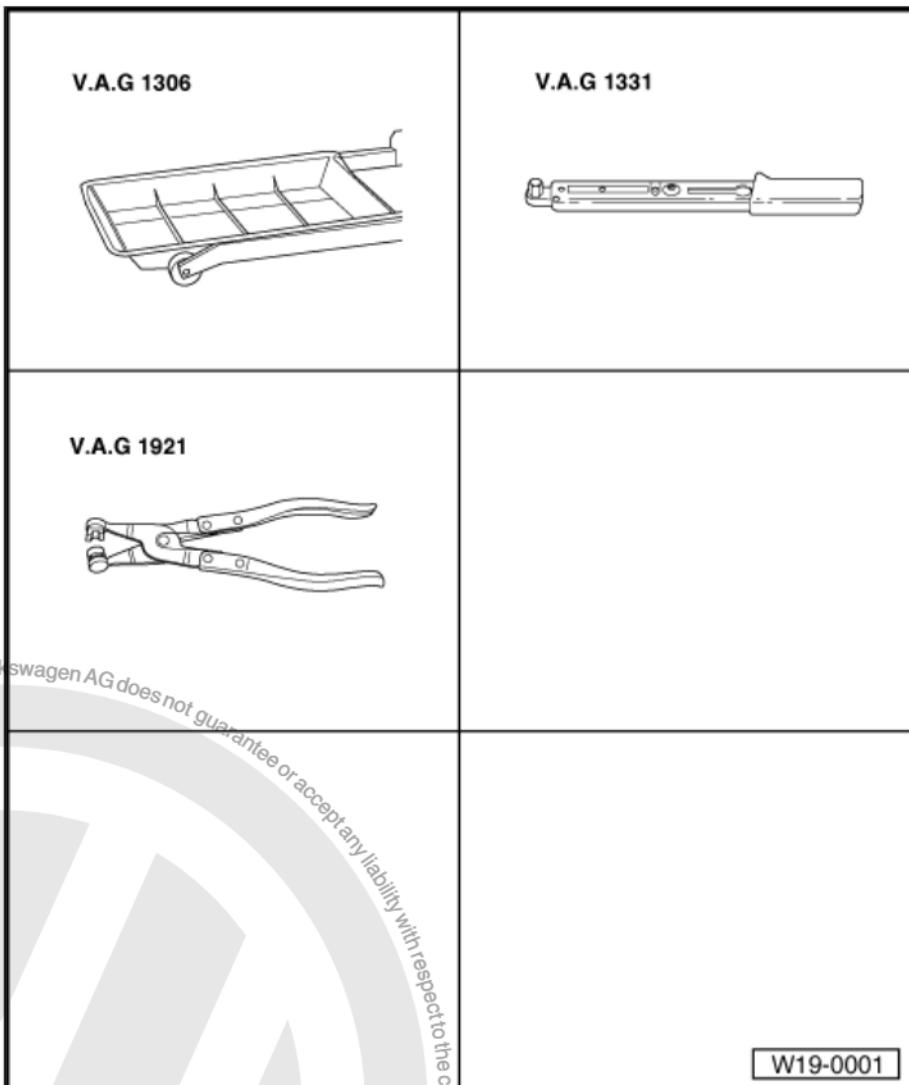
- Loosen cooling gas hose retaining clamp(s).
- Loosen radiator condenser and support it.

1.7 Thermostat valve - removal and installation



Special tools and workshop equipment required

- ◆ Oil trap - VAG 1306-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-
- ◆ Standard-type clamp pliers - VW 5162- or Standard-type clamp pliers - VAS 5024A- or Clamp pliers - VAG 1921-
- ◆ Refractometer - T10007A-



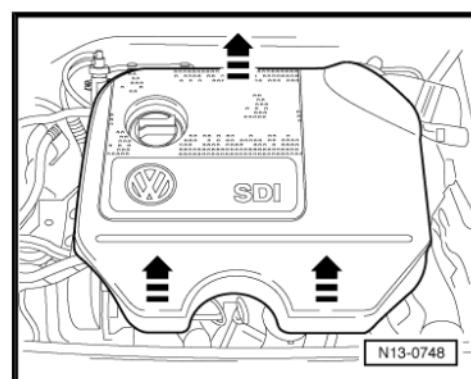
1.7.1 Removal



Note

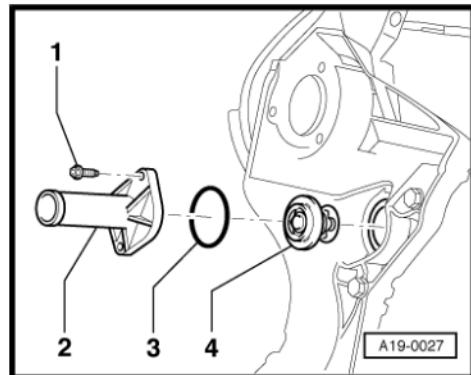
Sealing gaskets and rings must be always replaced.

- Remove the engine cover, -arrows-
- Drain cooling system **⇒ page 75** .





- Remove hose from connection flange -2-.
- Remove the securing bolts -1- of the connecting flange -2- and remove the connecting flange -2- with the thermostat valve -4-.
- Turn the thermostat valve -4- $1/4$ (90°) anticlockwise to remove from the connection flange-2- .



1.7.2 Installation

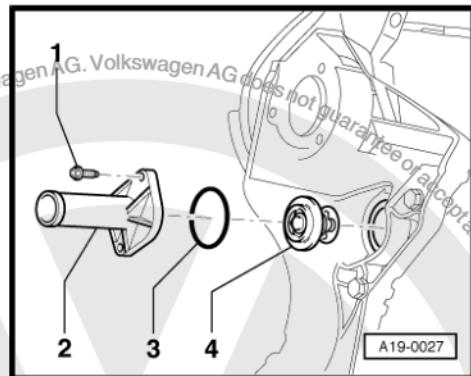
Install by inverting the removal sequence, paying attention to the following:

- Moisten the new sealing ring -3- with the coolant.
- Install thermostat valve -4- on connection flange -2- by turning $1/4$ 90° clockwise.



The arcs of thermostat valve must stand in an approx. upright position.

- Place the connection flange -2- with the thermostat valve -4- on engine block.
- Tighten the fastening screws -1-. Tightening torque: 15 Nm.
- Replenish cooling system [⇒ page 75](#) .





20 – Fuel supply system

1 Fuel supply system components - removal and installation



Note

- ◆ *The hose connections are fastened using spring or tightening clamps.*
- ◆ *Always replace tightening clamps with spring clamps.*
- ◆ *To install spring clamps, we recommend using the Standard-type clamp pliers - VW 5162- or Standard-type clamp pliers - VAS 5024A- or Clamp pliers - VAG 1921- .*

Follow safety measures [⇒ page 91](#) .

Follow cleaning rules [⇒ page 91](#) .

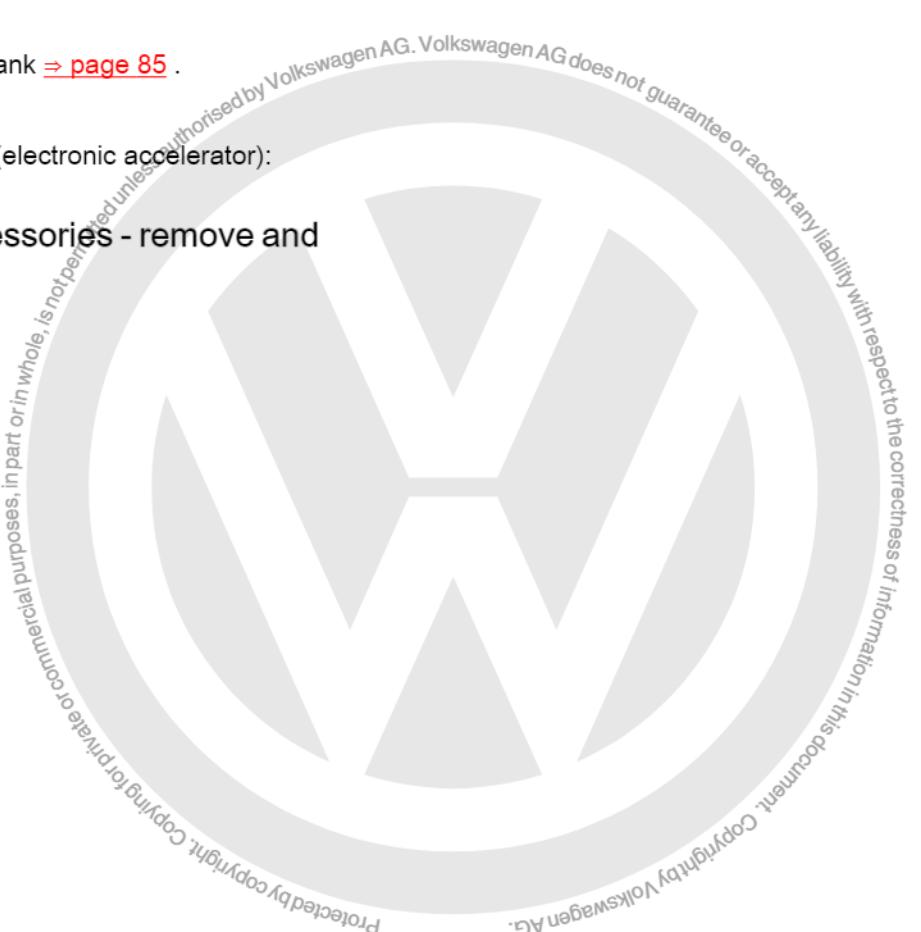
Removal and installation of the fuel tank [⇒ page 85](#) .

Repair fuel filter [⇒ page 89](#) .

Engine power electronic adjustment (electronic accelerator):
check [⇒ page 97](#) .

1.1 Fuel tank with accessories - remove and install

Fox





1 - Clip
2 - Fuel reservoir lid
3 - Ring
4 - Fastening screw
5 - Fuel tank nozzle compartment lid

- With rubber boot.
- Remove and install ⇒ General body repairs, exterior; Rep. gr. 555 ; Covers .

6 - Fuel supply line

7 - Vent valve

- From filter to environment.

8 - Gravity valve

- From fuel tank to breather valve.
- Check the valve for passage. Vertical valve: open. Inclined valve 45°: closed.

9 - Breather filter

- From breather valve to environment.

10 - Spring clamp

11 - Fuel reservoir

- Support with the Transmission jack or engine set + transmission or EQ 7081 - VAG 1383A-.

- Remove and install ⇒ [page 92](#) .

12 - 23..0.29 Nm

13 - Vent hose

- Fastened over the upper section of the fuel tank.
- Check fastening.

14 - Vent hose

- Fastened over the upper section of the fuel tank.
- Check fastening.

15 - Clip

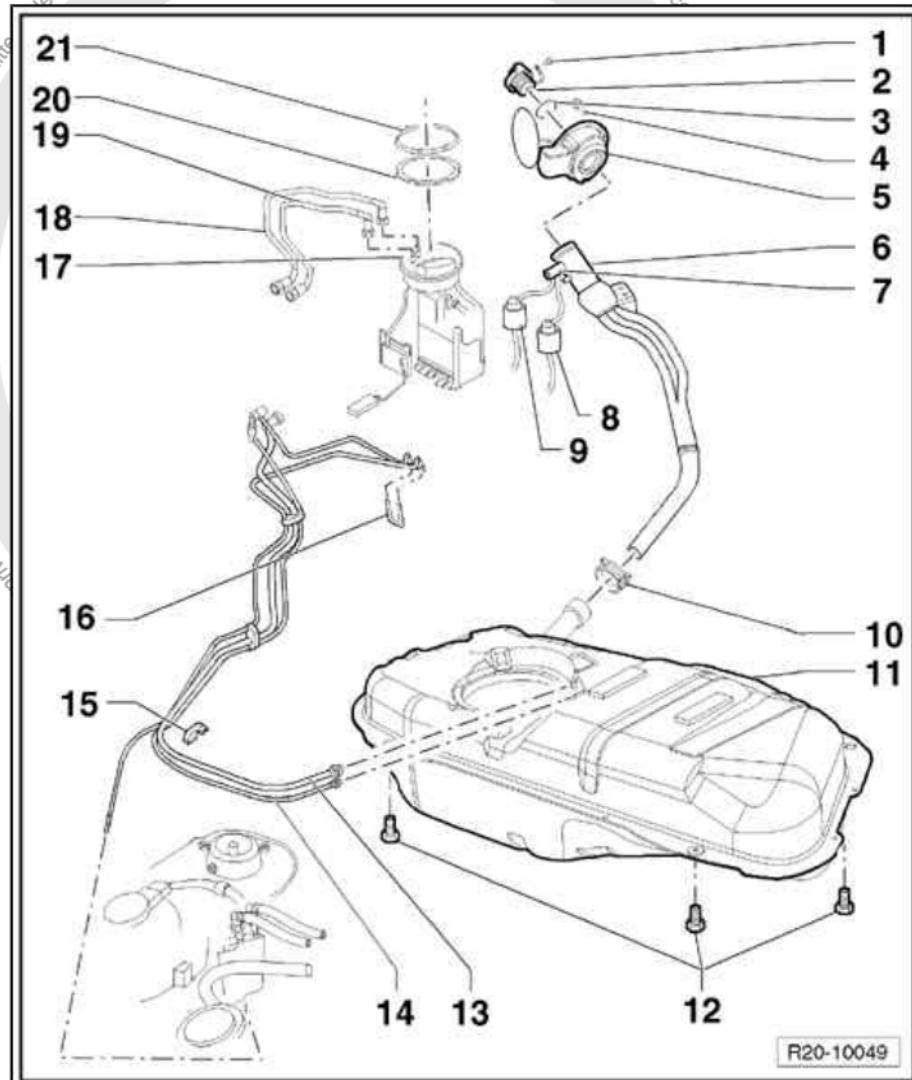
16 - Lock

17 - Fuel level indicator sensor - G-

- Check the installation position of flange in the fuel tank ⇒ [page 88](#)
- Removal and installation of the fuel tank ⇒ [page 93](#) .
- Removal and installation of the fuel tank gauge ⇒ [page 96](#) .

18 - Lines

- To fuel filter.
- Fastened to the fuel tank.
- Check fastening.
- Black.





19 - Return hose

- From the fuel filter.
- Blue or blue marking.
- Fastened to the fuel tank.
- Check fastening.

20 - Thrust ring

21 - Circlip

- Remove and install with a Wrench - VW 5321/9- or Wrench - T10334- .

SpaceFox

1 - Reservoir lid

2 - Fastening screw

3 - Fuel tank nozzle compartment lid

- With rubber boot.
- Remove and install ⇒ General body repairs, exterior; Rep. gr. 55 ; Covers .

4 - Gravity valve

- From fuel tank to breather valve.
- Check the valve for passage. Vertical valve: open. Inclined valve 45°: closed

5 - Earth connection

- Make sure it is well fastened.

6 - 10 Nm

7 - Vent hoses

- Fastened above the fuel tank.

8 - 25 Nm

9 - Fuel reservoir

- Support with the Transmission jack or engine set + transmission or EQ 7081 - VAG 1383A- .
- Remove and install ⇒ [page 92](#) .

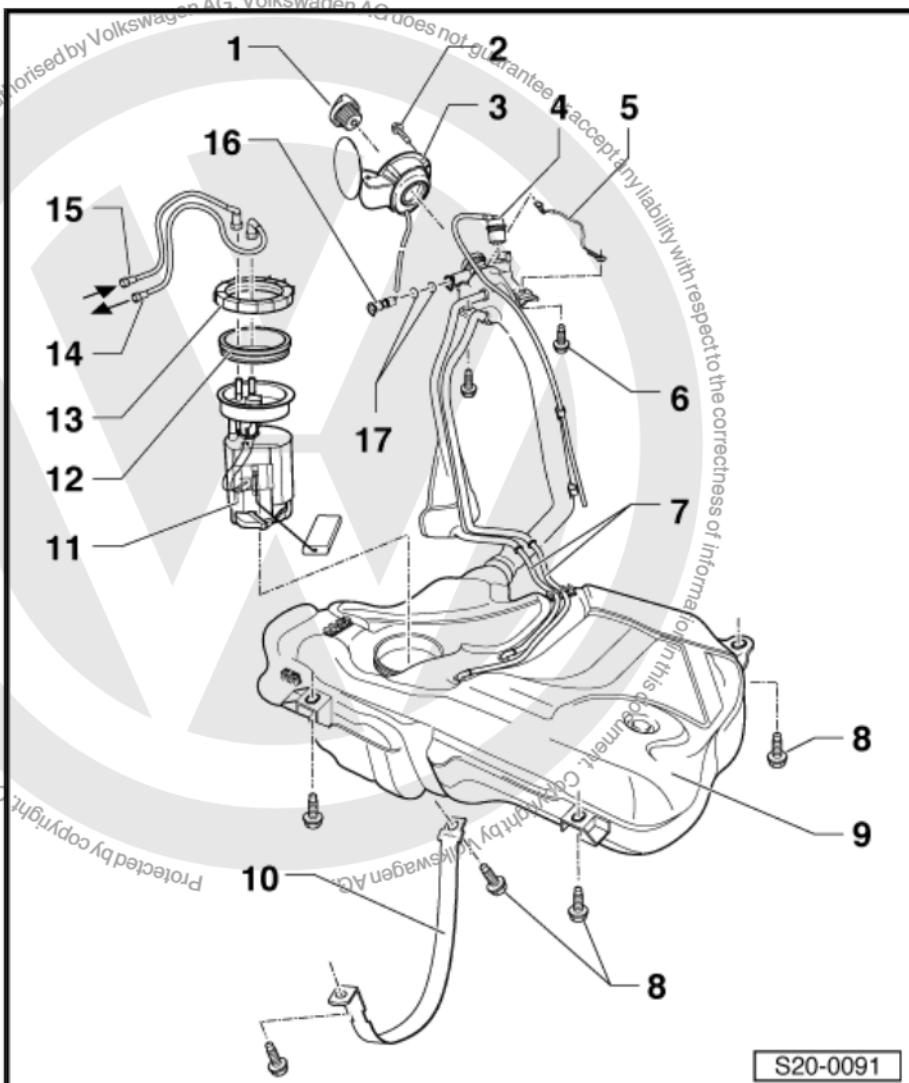
10 - Tension belt

11 - Fuel level indicator sensor - G-

- Check the installation position of flange in the fuel tank ⇒ [page 88](#)
- Removal and installation of the fuel tank ⇒ [page 93](#) .
- Removal and installation of the fuel tank gauge ⇒ [page 96](#) .

12 - Seal

- Replace when damaged.
- Moisten upon installation.



S20-0091



13 - Fastening nut

- Remove and install with Spanner - VW 5321/7 (Descontinuada) ou 3217- .

14 - Lines

- To the fuel filter.
- Fastened to the fuel tank.
- Black.
- To disconnect, press the connector lock key.

15 - Return hose

- From the fuel filter.
- Fastened to the fuel tank.
- Blue or blue marking.
- Make sure it is well fastened.
- To disconnect, press the connector lock key.

16 - Vent valve

- To remove, pull from clamps from the side.
- Before installation, remove the fuel tank cap.

17 - Sealing ring

- Replace when damaged.

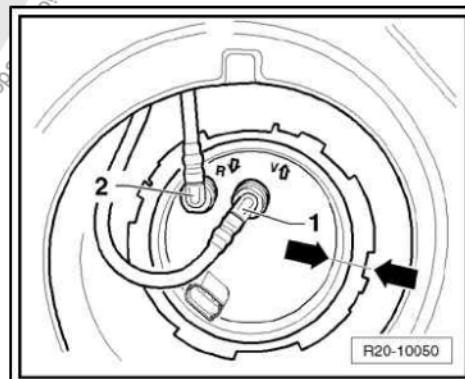
Fox

Installation position of Fuel level indicator sensor - G-

The -arrow- on Fuel level indicator sensor - G- must match to the marked dot on fuel tank -arrow-.

Black supply lines -1- or black-marked on connection with marking -V-.

Return lines -2- blue or blue-marked on connection with marking -R-.



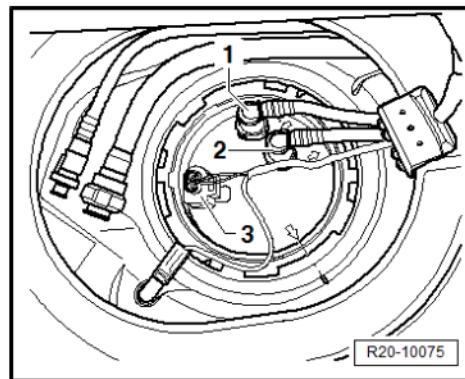
SpaceFox

The -arrow- on Fuel level indicator sensor - G- must match to the mark on fuel tank -arrow-.

Return lines -1- blue or blue-marked on connection with marking -R-.

Black supply lines -2- or black-marked on connection with marking -V-.

Electric connector of Fuel level indicator sensor - G- -3-.



Note

After installing the Fuel level indicator sensor - G- , check if the supply and return lines, and vent tubes, are still fastened to the fuel tank.



Check the vent valve

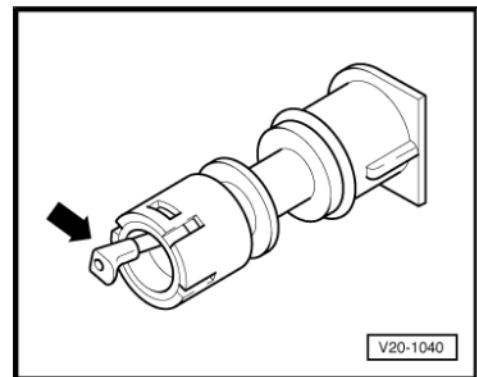
Lever in the resting position: closed.

Lever pushed in the -arrow -direction: open.



Note

Before vent valve installation, remove fuel reservoir lid.



1.2 Fuel filter - repair

FOX

1 - Return hose

- Of injection pump.
- Blue or blue marking.
- Check fastening.

2 - Supply hose

- To injection pump.
- White or white-marked.
- Check fastening.

3 - Clip

- Check fastening.

4 - Adjustment valve

- Installation position: Direction of-Arrow- for the fuel tank.
- When replacing the filter, remove clamp and adjustment valve with fuel lines connected.
- Below + 15° C: Filter passage open.
- Over + 31° C: Filter passage closed.

5 - Return hose

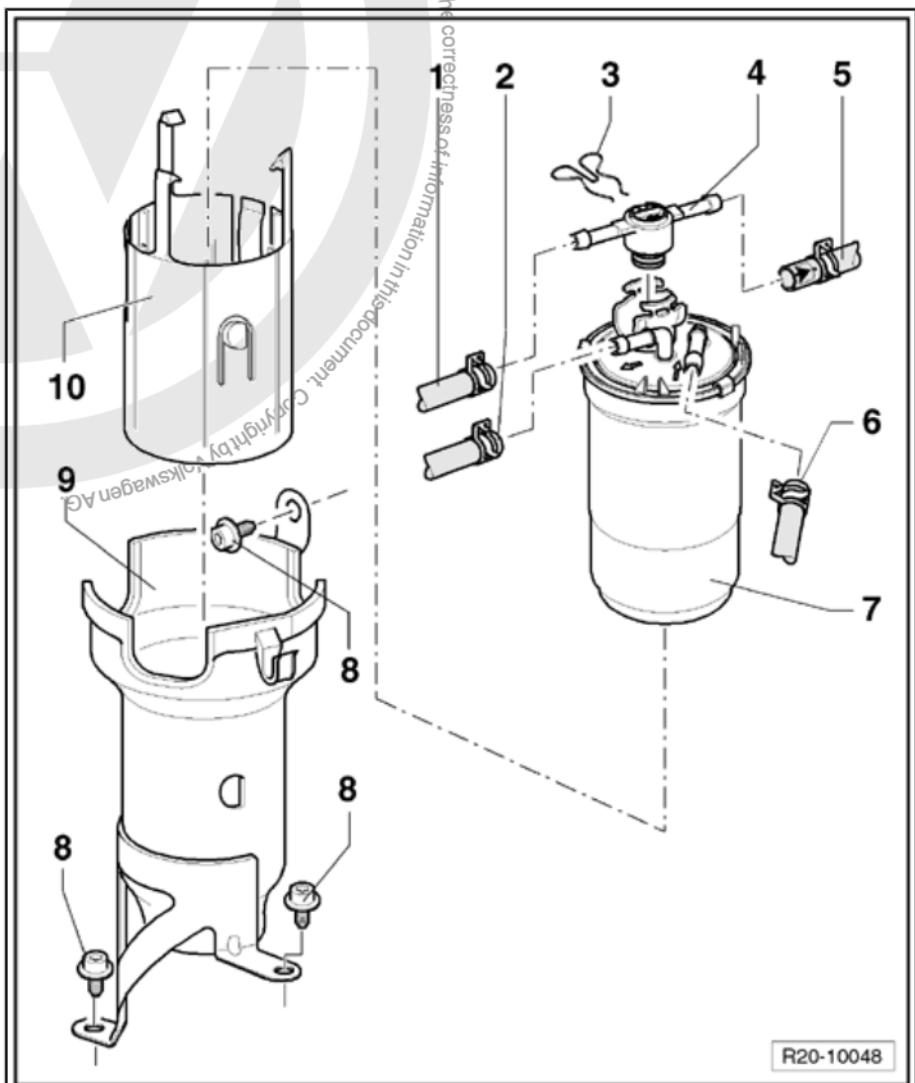
- To fuel filter.
- Blue or blue marking.

6 - Lines

- Tank.
- White or white-marked.

7 - Fuel filter:

- Remove and install
[⇒ page 91](#)
- Fill up with Diesel fuel before installation.
- Flow direction highlighted with -arrows-.
- Do not invert the connections.
- Replace when damaged.





8 - Washer

9 - 25 Nm

10 - Support to fuel filter

11 - Fitting/Locking Device

SpaceFox

1 - Return hose

- Of injection pump.
- Blue or blue marking.
- Check fastening.

2 - Supply hose

- To injection pump.
- White or white-marked.
- Check fastening.

3 - Clip

- Check fastening.

4 - Adjustment valve

- Installation position: Direction of Arrow- for the fuel tank.
- When replacing the filter, remove clamp and adjustment valve with fuel lines connected.
- Below + 15° C: Filter passage open.
- Over + 31° C: Filter passage closed.

5 - Return hose

- To fuel filter.
- Blue or blue marking.

6 - Lines

- Tank.
- White or white-marked.

7 - Fuel filter

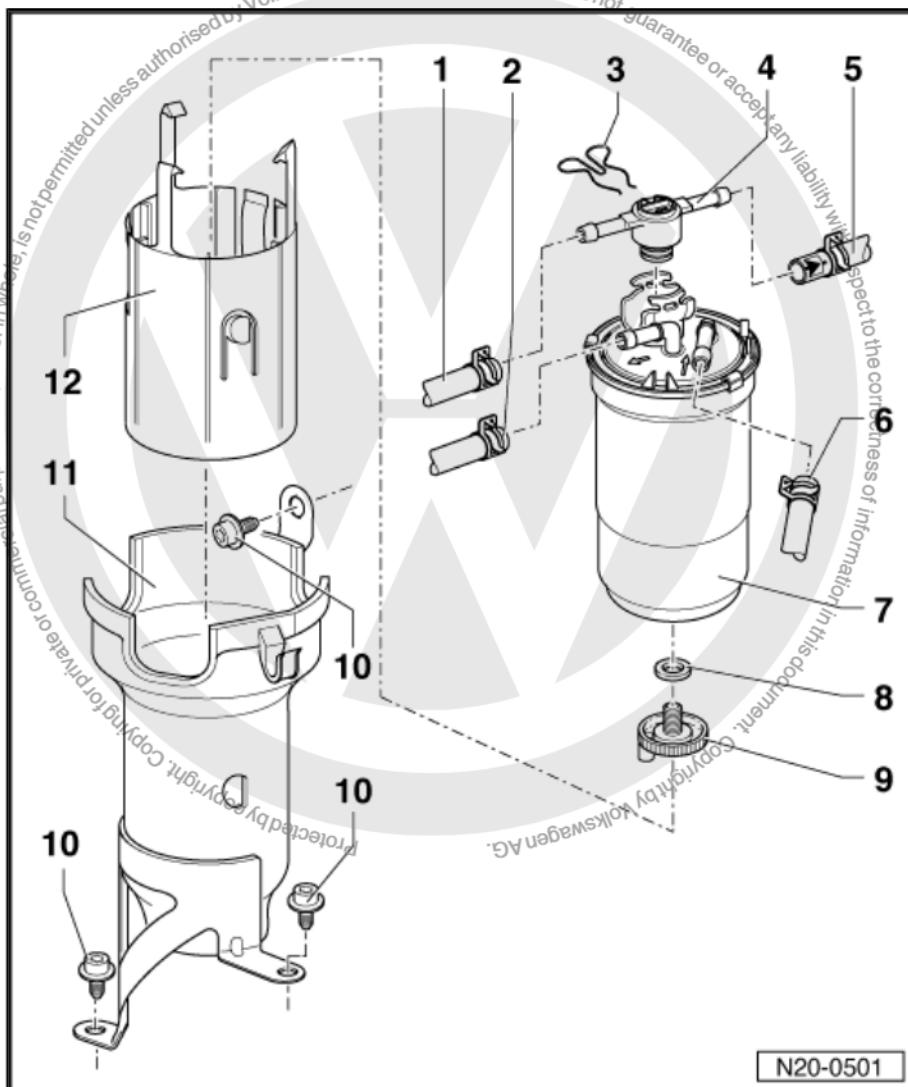
- Remove and install
[⇒ page 91](#)
- Fill up with Diesel fuel before installation.
- Flow direction highlighted with -arrows-.
- Do not invert the connections.
- Replace when damaged.

8 - Sealing ring

- Replace when damaged.

9 - Drain

- For ventilation, loosen the clip and remove the adjustment valve with fuel lines connected.
- Drain approx. 100 ml of fuel.





10 - 25 Nm

11 - Support to fuel filter

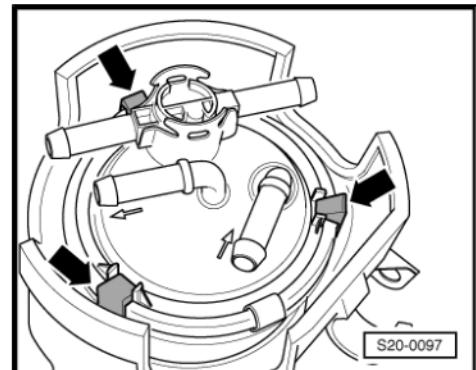
12 - Fitting/Locking Device

Remove and install the fuel tank

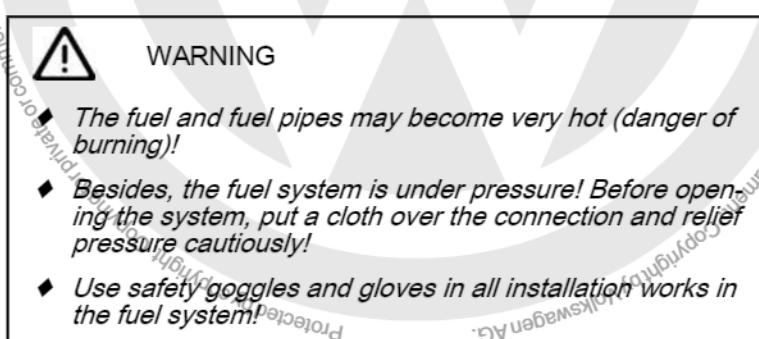
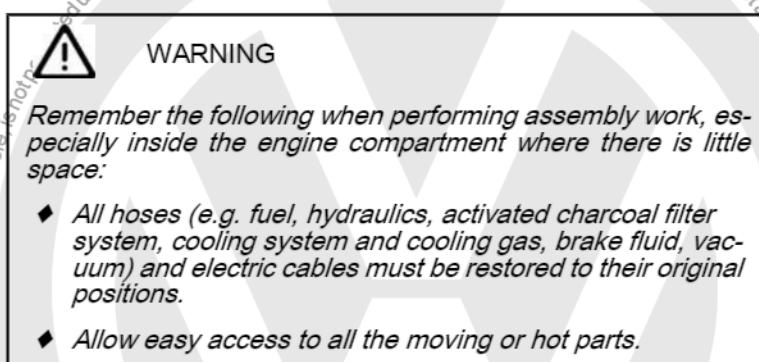
Pull the locks -arrows- away and remove the fuel filter.



The fuel filter can be installed in only one position.



1.3 Safety measures when working on supply system



When removing and installing the Fuel level indicator sensor - G- from full or partially full tanks, observe the following:

- ◆ Prior to beginning work, place the suction hose from the gas extraction (exhaust) equipment near the fuel tank installation area. It should be operational and must be able to absorb the gases released by the fuel. If an extracting device is unavailable, use a radial fan (the engine must be out of air flow) with rate of air displacement greater than $15 \text{ m}^3/\text{hour}$.
- ◆ Avoid skin contact with fuel! Wear fuel resistant gloves!

1.4 Cleaning rules

For cleaning, carefully observe these "6 rules" when working on the fuel supply/injection system:

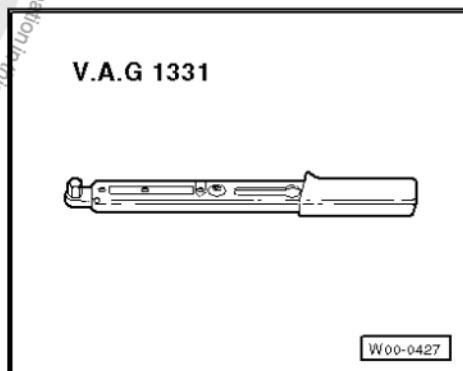


- ◆ Thoroughly clean the connections and surrounding areas before disconnecting them.
- ◆ Removed parts must be placed onto a clean surface and covered. Do not use cloths that fray!
- ◆ If the repair work will not be performed immediately, exposed components must be covered or carefully preserved.
- ◆ Install clean components only. Remove spare parts from packaging just prior to installation. Do not install components that have been stored outside of packaging (i.e. inside a tool box, etc.).
- ◆ With the system open: If possible, avoid using compressed air. Do not move vehicle, if possible.
- ◆ Be careful to avoid contact of diesel fuel with the cooling system lines. If this happens, the lines must be cleaned immediately. Damaged hoses must be replaced.

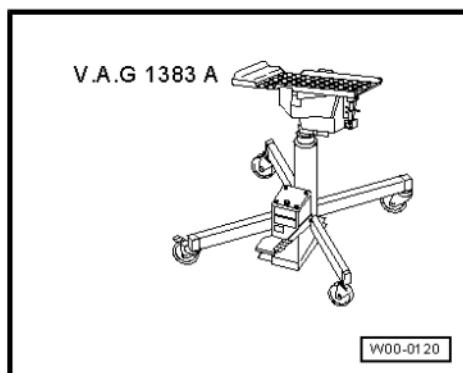
1.5 Fuel reservoir - remove and install

Special tools and workshop equipment required

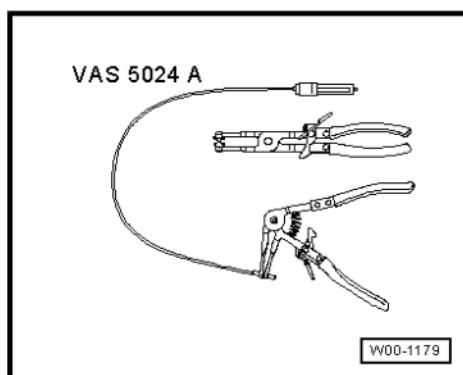
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-



- ◆ Gearbox or engine + gearbox assembly jack - EQ 7081- or Gearbox or engine + gearbox assembly jack - VAG 1383A-



- ◆ VAS 5024A or Standard-type clamp pliers - VW 5162- or Pliers - VAG 1921-





1.5.1 Removal

- Check safety measures before work [⇒ page 91](#) .



Note

During the work, the Battery - A- earth strap must be disconnected. First, check if the vehicle is equipped with a coded radio. If so, obtain the anti-theft code prior to beginning work.

With the ignition turned off, disconnect the earth wire from the battery - A- .

- Fold rear seat forward.
- Remove the cover to access the Fuel level indicator sensor G- and disconnect the 2-pole connector.
- Empty the fuel tank.
- Remove the tank cap.
- Remove hoses from the fuel tank.
- Lower the exhaust system a little, and fasten it with a metal wire.
- Remove the heat deflector between the exhaust and the fuel tank.
- Remove fastening clamps to supply tube using the Standard type clamp pliers or VAS 5024A - VW 5162- or Pliers - VAG 1921- .

Support the fuel tank with Gearbox or engine + gearbox assembly jack - EQ 7081- or Gearbox or engine + gearbox assembly jack - VAG 1383A- .

- Remove fastening screws from the fuel tank.
- Lower the fuel tank.



Note

To disconnect hose connections, press the keys on connections.

1.5.2 Installation

Install in reverse order to the removal. Please note the following:

- ◆ Place the fuel vent hoses so as to avoid folds.
- ◆ Make sure the fuel hoses are firmly fastened.
- ◆ Do not invert the fuel and return lines (blue return line, or with blue marking, respectively)
- ◆ Separate the supply and return hoses of fuel tank.



Note

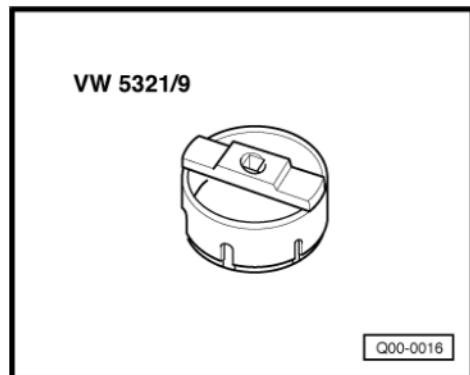
After installing the Fuel level indicator sensor - G- , check if the supply and return lines, and vent tubes, are still fastened to the fuel tank.

1.6 Fuel level indicator sensor - G-

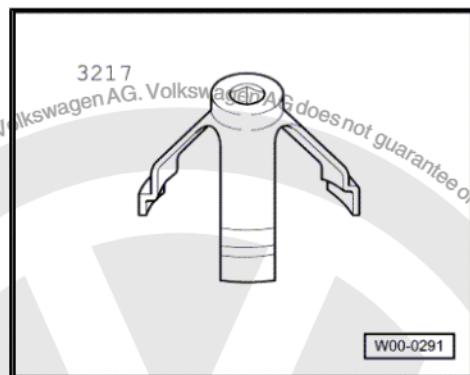
Special tools and workshop equipment required



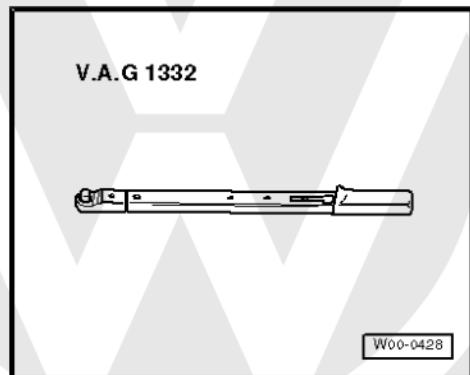
- ◆ Wrench - VW 5321/9- or Wrench - T10334-



- ◆ Key - VW 5321/7 (Descontinuada) ou 3217-



- ◆ Torque meter - 40 to 200 Nm (enc. 1/2") - VAG 1332-



1.6.1 Removal

Follow safety measures [page 91](#) .

Follow cleaning rules [page 91](#) .

- First, check if a code radio equipment is installed. If this is the case, request the anti-theft code.
- With the ignition turned off, disconnect the earth wire from the battery - A- .
- Fold rear seat forward.
- Remove the cover to access the Fuel level indicator sensor - G- and disconnect the 2-pole connector from flange
- Disconnect the 2-pole connector and the supply and return hoses from Fuel level indicator sensor - G- .



WARNING

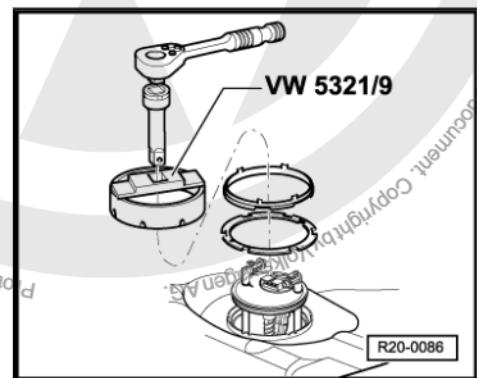
- ◆ The fuel and fuel pipes may become very hot (danger of burning)!
- ◆ Besides, the fuel system is under pressure! Before opening the system, put a cloth over the connection and relief pressure cautiously!
- ◆ Use safety goggles and gloves in all installation works in the fuel system!



Note

Accordingly, press to the keys on the line couplings.

- Release the Fuel level indicator sensor - G- with the Wrench - VW 5321/9 - or Wrench - T10334- .



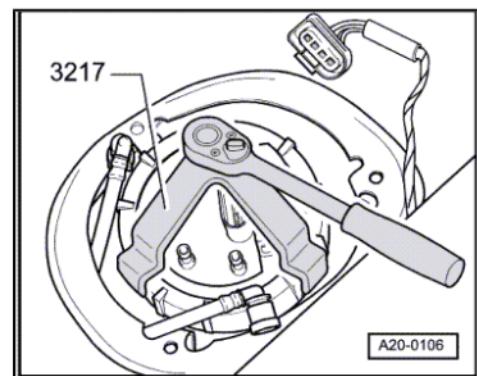
SpaceFox

- Remove Fuel level indicator sensor - G- from fuel tank.



Note

If planned, replace the Fuel level indicator sensor - G- , the used Fuel level indicator sensor - G- must be cleaned before disposal.



1.6.2 Installation

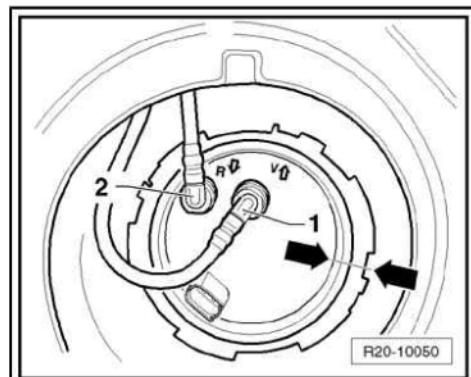
- Installation of the Fuel level indicator sensor - G- is made in reversal order from removal.



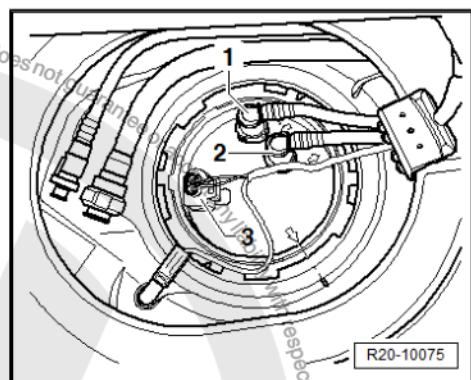
Note

- ◆ Do not fold the fuel level indicator sensor.
- ◆ The sealing ring of Fuel level indicator sensor - G- must be installed dry onto the fuel tank opening.
- ◆ Moisten the sealing ring with fuel only when installing the Fuel level indicator sensor - G- .
- ◆ Make sure the fuel hoses are firmly fastened.
- ◆ After installing the Fuel level indicator sensor - G- , check if the supply and return lines, and vent tubes, are still fastened to the fuel tank.
- Installation disposition of the Fuel level indicator sensor - G- : The -arrow- on the flange must match the mark on the fuel tank -arrows-.

Fox



Spacefox



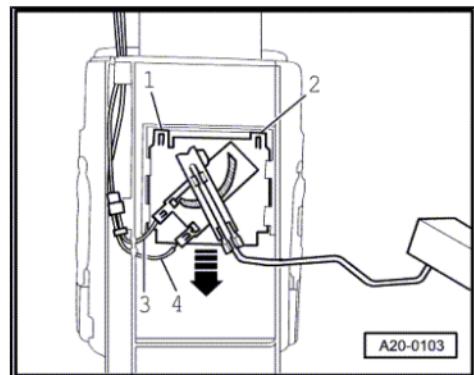
1.7 Fuel level gauge - remove and install

1.7.1 Removal

- Remove the Fuel level indicator sensor - G- [⇒ page 93](#) .



- Disconnect the connection of cables -3- and -4-.
- Raise the locks -1- and -2- with a screwdriver and remove the fuel level indicator sensor -arrows-.



1.7.2 Installation

- Insert the fuel level gauge onto guides and press down until fitting.

1.8 Engine power electronic adjustment (electronic accelerator): check

1 - Pedal support

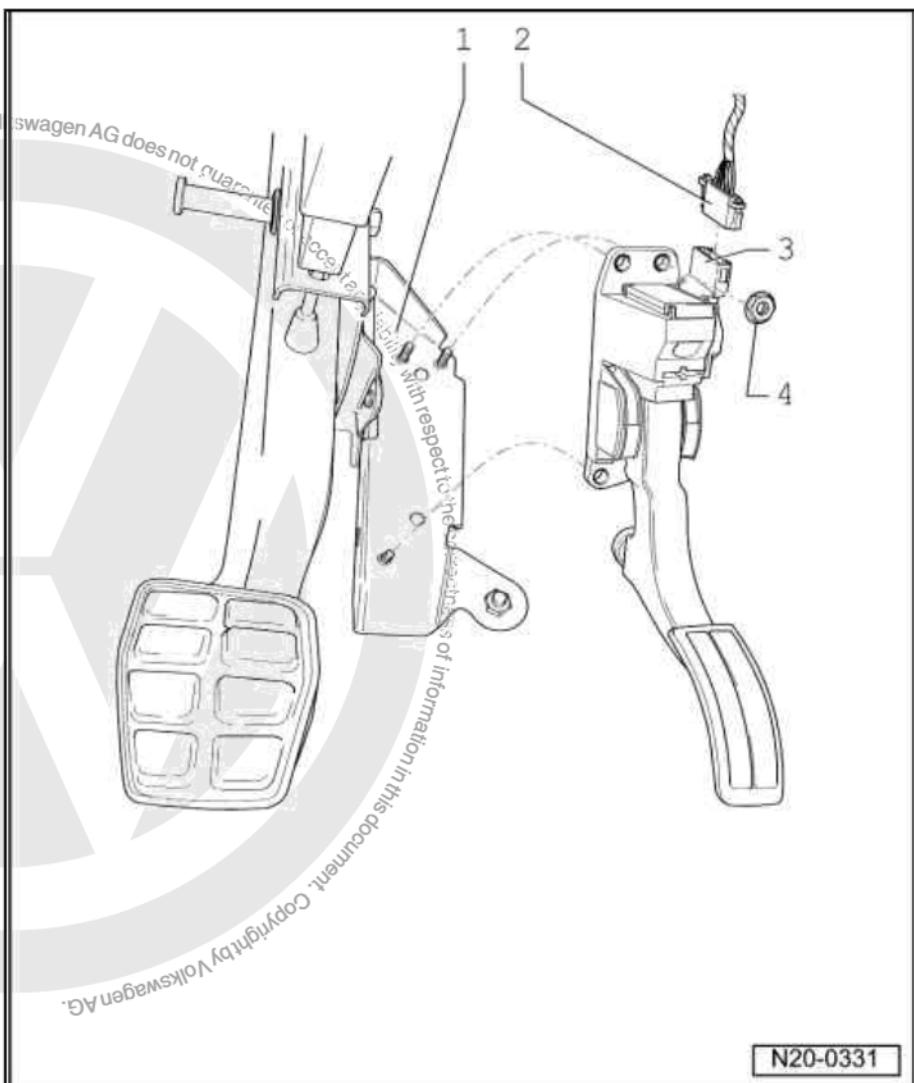
2 - Connector

Black, 6 poles.

3 - Accelerator pedal position sensor - G79-

The Accelerator pedal position sensor - G79- transmits the driver's intention to the Engine control unit - J623- .

4 - 10 Nm





23 – Mixture preparation - injection

1 Diesel direct injection system - repair

The Engine control unit - J623- is equipped with an event memory. The event memory must be checked before and after repairs or adjustment works [⇒ page 110](#).

Safety measures [⇒ page 98](#).

Cleaning rules [⇒ page 91](#).

1.1 Safety measures



WARNING

Remember the following when performing installation work, especially inside the engine compartment where there is little space:

- ◆ All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling system and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.
- ◆ Allow easy access to all the moving or hot parts.

Consider the following in order to avoid personal injury and/or deterioration of the injection and pre-heating systems:

- ◆ Disconnect and connect cables and wires of the injection and pre-heating systems, as well as the cables of measurement devices, always with the ignition off.
- ◆ When engine must operate with start speed without beginning to function, e.g., during a compression test, disconnect the 10-pin connector of the injection pump.
- ◆ Before turning off the Battery - A- of radios with anti-theft code, request the anti-theft code.
- ◆ Disconnection and connection of Battery - A- may only occur with ignition off, otherwise the Engine control unit - J623- may be damaged.

If there is the need of measurement and test devices during a test drive, please observe the following:

- ◆ Test and measurement devices must always be fixed to rear seat and managed from there by a second person.

If test and measurement devices are operated from the passenger seat, the passenger seated there may suffer injuries in case of accident due to triggering of the airbag.

1.2 Cleaning rules

For cleaning, carefully observe these "6 rules" when working on the fuel supply/injection system:

- ◆ Thoroughly clean the connections and surrounding areas before disconnecting them.
- ◆ Place parts on clean surface and cover them. Use lint-free cloths!
- ◆ If the repair work will not be performed immediately, exposed components must be covered or carefully preserved.



- ◆ Install clean components only. Remove spare parts from packaging just prior to installation. Do not install components that have been stored outside of packaging (i.e. inside a tool box, etc.).
- ◆ With the system open: If possible, avoid using compressed air. Do not move vehicle, if possible.
- ◆ Be careful to avoid contact of diesel fuel with the cooling system lines. Otherwise, the lines must be cleaned immediately. Damaged hoses must be replaced.

1.3 Injection pump - repair

- ◆ Follow cleaning rules [⇒ page 91](#) .
- ◆ Remove and install the injection pump [⇒ page 102](#) .
- ◆ Check and dynamically adjust the start of injection [⇒ page 111](#) .
- ◆ Always replace sealing rings.

1 - 25 Nm

2 - Injection pump gear

- Remove and install [⇒ page 102](#) .

3 - Fastening nut

- To the hub.
- Never release. Otherwise the basic adjustment of injection pump is affected and cannot be adjusted with the usual resources of a workshop.

4 - Flange, 25 Nm

- To the supply line.

5 - Sealing ring

- Replace.

6 - Fuel shutoff valve - N109- , 40 Nm

7 - Connection nozzle

- To the return line.

8 - Return hose

- To adjustment valve/ fuel filter.

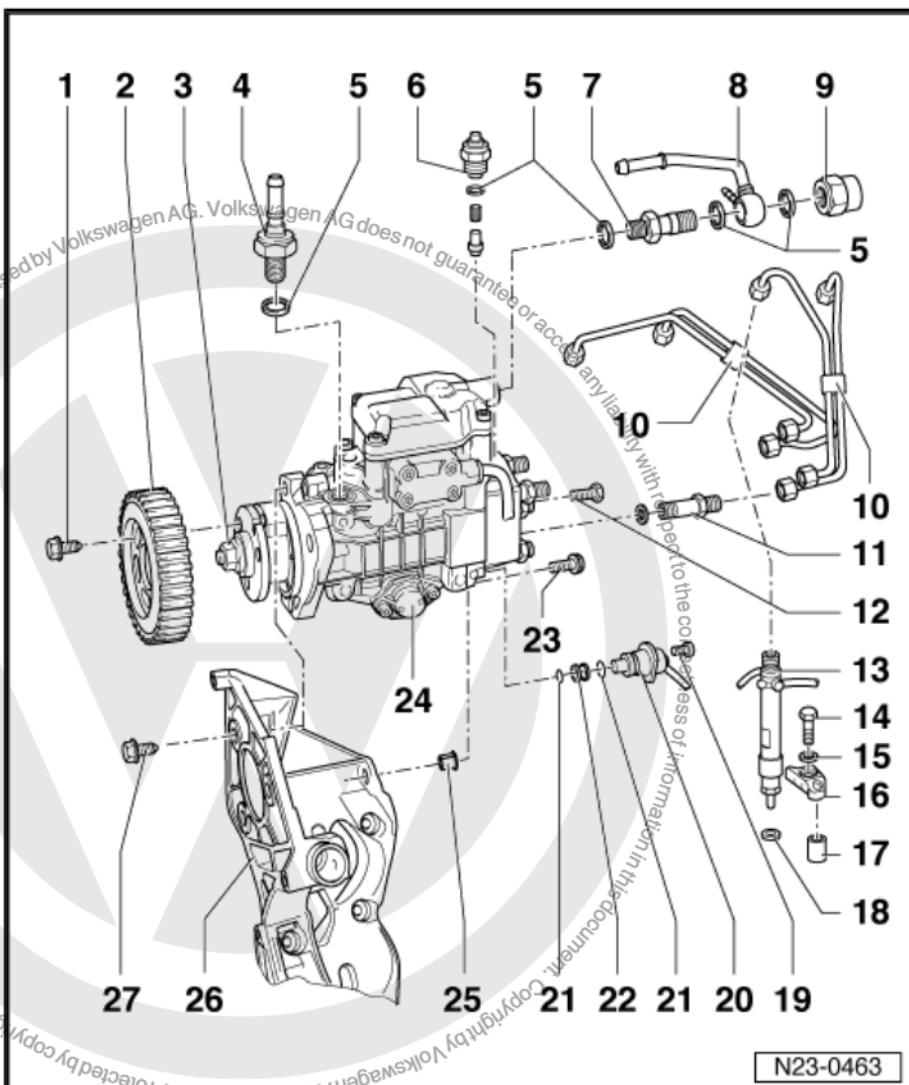
9 - 25 Nm

10 - Injection Tubes

- Tighten them to 25 Nm.
- Remove with Open star wrench - 3035- .
- Always remove the complete set of tubes.
- Do not change the curvature.

11 - Flange, 45 Nm

- With pressure valve.





12 - 25 Nm

13 - Injector

- For the 3rd cylinder, with needle travel sensor.
- Remove and install [⇒ page 106](#).
- Check [⇒ page 108](#).

14 - 20 Nm

15 - Washer

16 - Bearing

17 - Spacer sleeve

18 - Thermal protection plate

- Replace.

19 - 10 Nm

20 - Valve to initiate injection - N108-

21 - Sealing ring

- Replace.

22 - Net filter

23 - 30 Nm

24 - Injection regulator case cap

- In case of leakage, replace the sealing ring [⇒ page 109](#).

25 - Sleeve

- With nut.

26 - Compact support

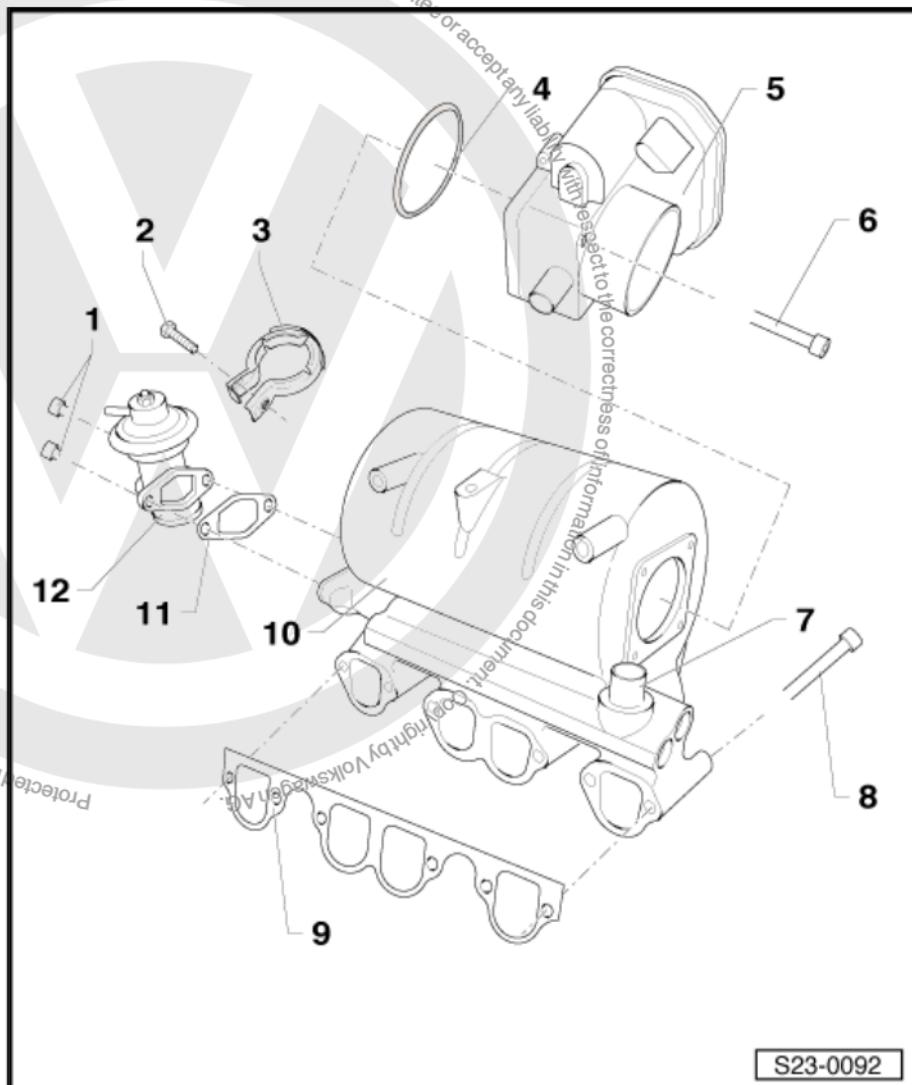
- Remove and install [⇒ page 11](#).

27 - 30 Nm



1.4 Intake manifold - remove and install

- 1 - 25 Nm
- 2 - 10 Nm
- 3 - Clamp
- 4 - Sealing ring
 - Replace.
- 5 - Intake manifold valve motor - V157-
- 6 - 10 Nm
- 7 - Crankcase ventilation connection
- 8 - 20 Nm
- 9 - Gasket
 - Replace.
- 10 - Intake manifold
- 11 - Gasket
 - Replace.
- 12 - Valve of exhaust gas recirculation

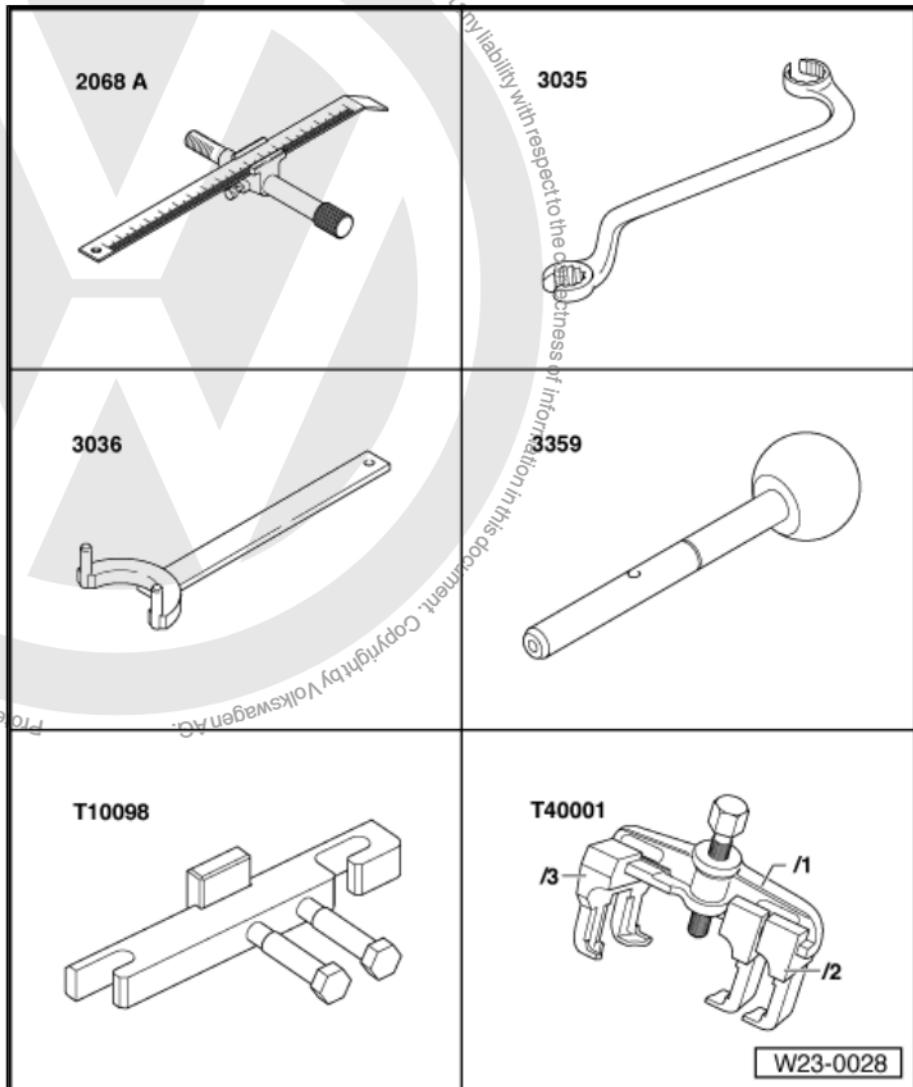




1.5 Injection pump - remove and install

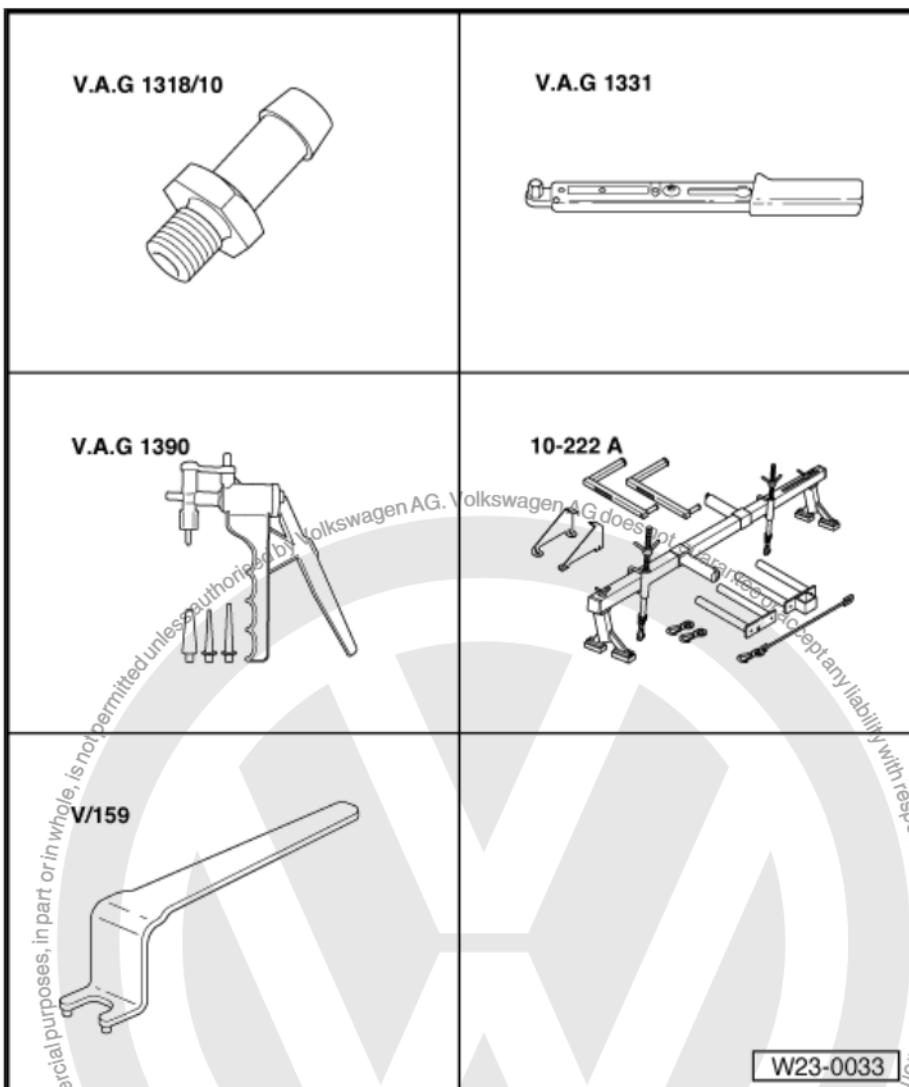
Special tools and workshop equipment required

- ◆ Device for top dead centre adjustment. - 2068 A-
- ◆ Star socket - 3035 -
- ◆ Special wrench - 3036-
- ◆ Lock pin - 3359-
- ◆ Alignment bar - T 10098A-
- ◆ Puller - T 40001-
- ◆ Adapter - V.A.G 1318/10-





- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-
- ◆ Vacuum pump - VAG 1390 (VWB) - ou - VAS 6213-
- ◆ Support or VW 061 - 10-222A- with feet - 10 - 222A/1-
- ◆ Key - V 159-



1.5.1 Removal

- Remove toothed belt [⇒ page 36](#) .



Note

The pulley/vibration damper of belt, and the lower section of toothed belt, can remain installed.

- Loosen all fuel lines from the pump.

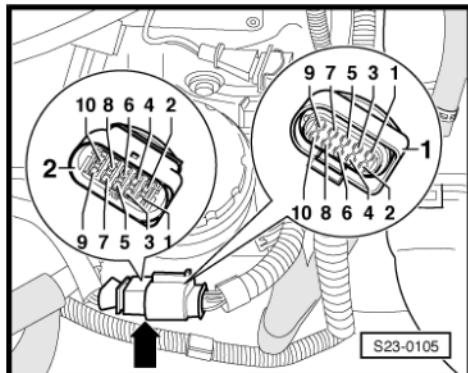


Note

- ◆ *To remove the injection tubes, use the Open ring spanner - 3035- .*
- ◆ *Do not change the curvature.*
- Cover the openings with a clean cloth.



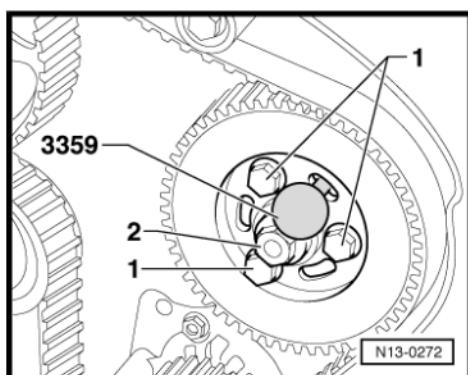
- Disconnect the 10-pin connection to injector pump and remove connector from support.



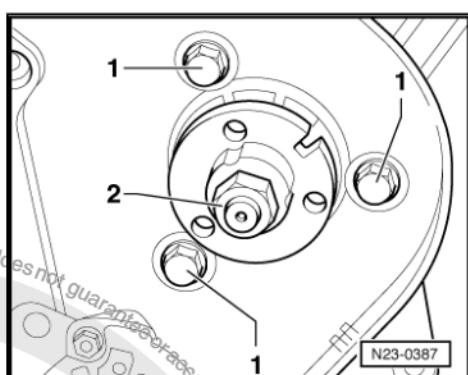
- Loosen the bolts -1- that secure the injection pump gear.



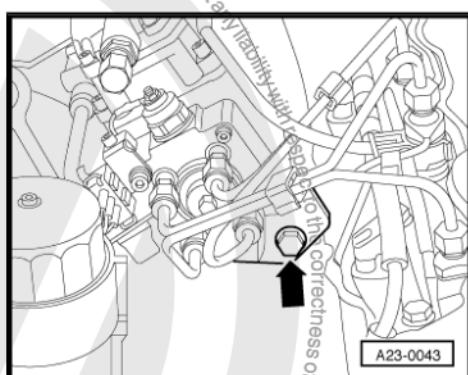
The hub nut -2- should not get loose under any circumstance. Otherwise the basic adjustment of injection pump is affected and cannot be adjusted with the usual resources of a workshop.



- Remove fastening bolts -1- from compact support.



- Remove the fastening bolt of rear support -arrow-.
- Remove the injection pump.

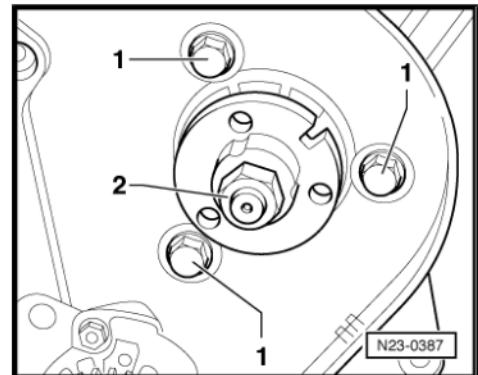


1.5.2 Installation

- Install the injection pump onto the compact support, and fasten it first onto rear support with the fastening nut.



- Install fastening screws -1- to (30 Nm) torque.

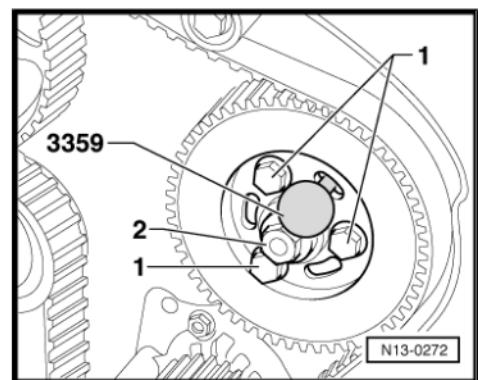


- Do not tighten the injection pump gear with fastening bolts -1- on hub.
- Lock the injection pump gear with the Lock pin - 3359- .
- Centralize the injection pump gear with the elongated holes.
- Loosen one turn the screw that secures the camshaft gear. To loosen the bolt, immobilize the camshaft gear with a Pin wrench - 3036- .

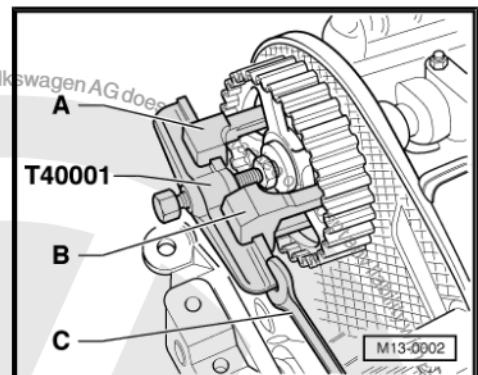


Note

To loosen and tighten the camshaft gear, never use the Alignment rod - T 10098A- ! Use the Pin wrench - 3036- .



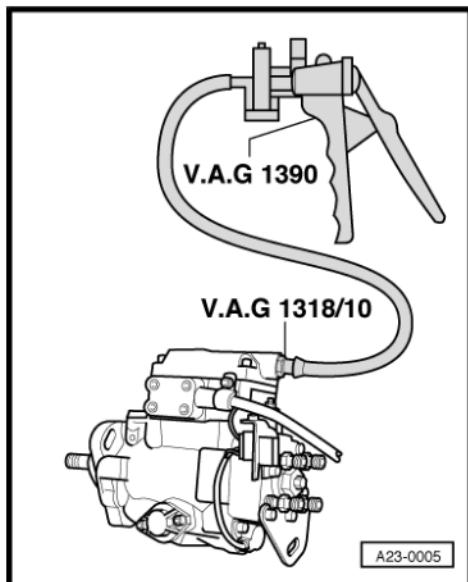
- Place the Puller - T40001- with the one-arm claw - T40001/2-A- and Two-arm claw - T40001/3- -B- centred over the cam-shaft gear, and remove the gear. During this procedure, use as supporting element a spanner -C-.
- Remove the camshaft gear.
- Check if the OT mark on flywheel aligns with the reference mark.
- Install the timing belt on the injection pump gear and tensioner pulley.
- Place the camshaft gear into toothed belt and fix camshaft gear so that it can rotate.
- Adjust the drive belt [⇒ page 36](#) .
- Connect injection lines, fuel supply line and all electric connections.





Fill up the injection pump with fuel as follows.

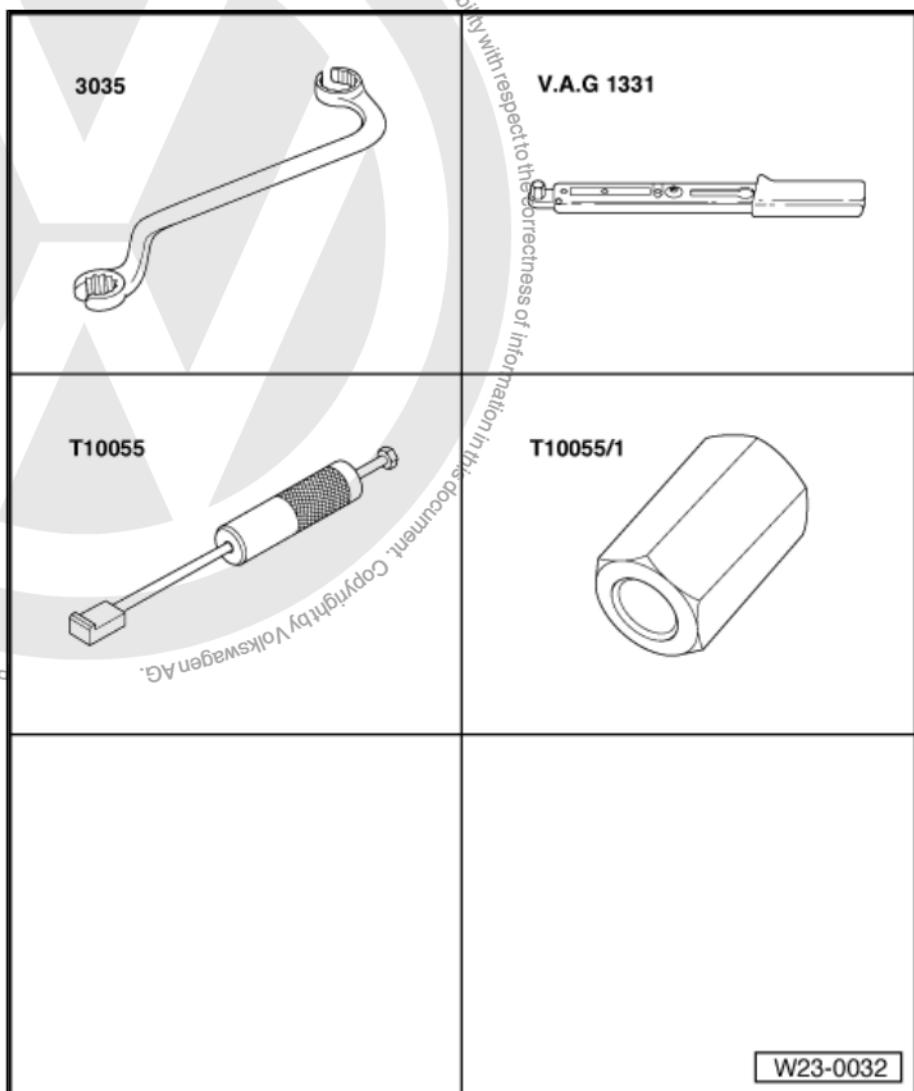
- Install the Adapter - V.A.G 1318/10- in the return opening of the injection pump.
- Connect Vacuum pump - VAG 1390 (VWB) - ou - VAS 6213- with approx. 1 metre of clear plastic hose on adapter.
- Activate the Vacuum pump - VAG 1390 (VWB) - ou - VAS 6213- until there is fuel coming out of return opening. Do not pull fuel until the Vacuum pump - VAG 1390 (VWB) - ou - VAS 6213- .
- Remove Adapter - V.A.G 1318/10- and connect the fuel return line.
- Check dynamically the injection start, adjust if necessary
⇒ [page 111](#) .



1.6 Nozzles - remove and install

Special tools and workshop equipment required

- ◆ Star wrench - 3035 -
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331 -
- ◆ Puller - T 10055 -
- ◆ Adapter - T 10055/1 -





Note

- ◆ Defective injectors produce the following results:
- ◆ Ignition failure
- ◆ Metallic knocks in one or more pistons
- ◆ Engine overheating.
- ◆ Low efficiency.
- ◆ Excessive black fumes from exhaust tube
- ◆ High fuel consumption.
- ◆ Excessive blue fumes at cold start

Defective injectors can be identified by releasing in sequence the cover nuts from injection pipes with engine in idle. If engine rotation remains constant after releasing a cap nut, this means a defective injector.

1.6.1 Removal

- To remove the injection tubes, use the Open ring spanner 3035.



Note

Always remove the entire line assembly, do not change curvature.

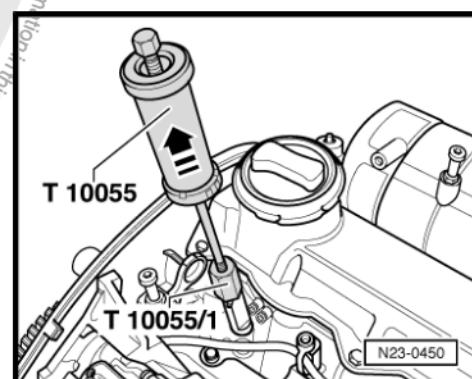
- Loosen securing bolt, remove the lock bearing and remove the injector.



Note

To remove locked injectors, use Puller - T 10055- with Adapter - T 10055/1- .

- Install the Puller - T 10055- with Adapter - T 10055/1- onto injector.
- Remove the injector with light blows in direction of the -arrow-, and pull it away from cylinder head housing.



1.6.2 Installation



Note

Always replace heat deflecting gaskets between cylinder head and injectors.

- Install the nozzles.



- Check for correct seating of fastening bearings on cylinder head.
- Install locking handle.

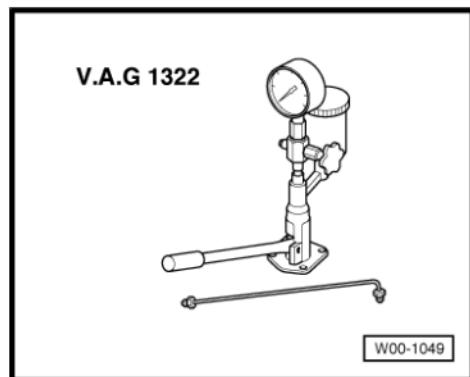
Tightening torques: Injection Tubes = 25 Nm. Screw for the locking bearing = 20 Nm

1.7 Injectors - check

These engines are equipped with two-spring injectors. Due to this, the injection of fuel occurs in two stages. In the event of failure in these injectors, only replacement is allowed, as it is not possible to adjust pressure or repair the injectors.

Special tools and workshop equipment required

- ◆ Injector testing device - VAG 1322- with Pressure tube - V.A.G 1322/2-



1.7.1 Checking conditions

- Pressure gauge connected

1.7.2 Check injection pressure

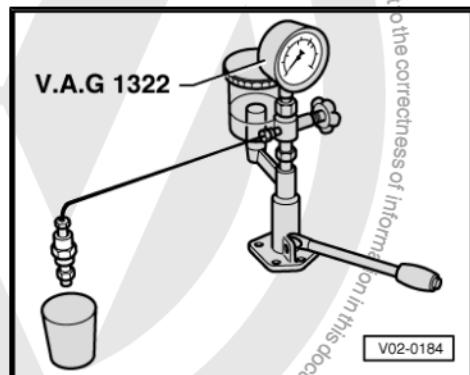


WARNING

During the injectors' test, be careful for the fuel spray not to hit the hands, as the high pressure of fuel can penetrate into skin and cause serious injuries.

- Remove injector [page 106](#).
- Install injector onto Injector testing device - VAG 1322- .
- Press lever of the Injector testing device - VAG 1322- downwards. At the start of injection, read the injection pressure. If pressure is out of nominal value, replace the injector.

Theoretical values: new injector pressure: 220... 230 bar. Wear limit: 190 bar.



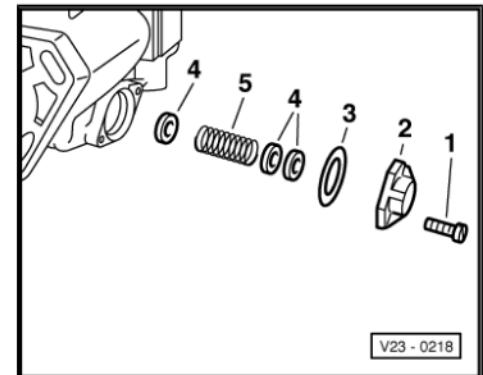
1.7.3 Check seal

- Press lever of Injector testing device - VAG 1322- slowly downwards and keep pressure for 10 seconds in approx. 150 bar. No fuel can leak from the injector opening.
- In case of leaks, replace the injector.



1.8 Sealing ring of the cap of injection adjuster - replace

- Place a clean cloth under the injection pump.
- Remove bolts from the cover -1- with a Torx angle wrench for bolts -Torx- e.g. Hazet 2115-T30.
- Remove the cover -2- and clean.
- Replace the sealing ring -3- and install the lid with the existing compensation discs -4-.





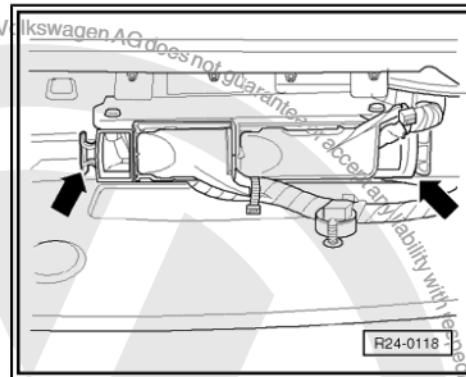
2 Control unit of Diesel direct injection system - J248-

2.1 Control unit of Diesel direct injection system - J248- - remove and install

- Before removing the Control unit of Diesel direct injection system - J248- , there must be selected the identification of the Control unit of Diesel direct injection system - J248- and the coding of the Control unit of Diesel direct injection system - J248- used so far [⇒ page 110](#) .

2.1.1 Removal

- Turn ignition off.
- Remove the arms and wipers from the windscreen and the lower trim of the windscreen frame:
- Disconnect the connectors from Control unit of Diesel direct injection system - J248- by pulling them away-arrows-
- Slide the Control unit of Diesel direct injection system - J248- to remove it from rails in the support.



2.1.2 Installation

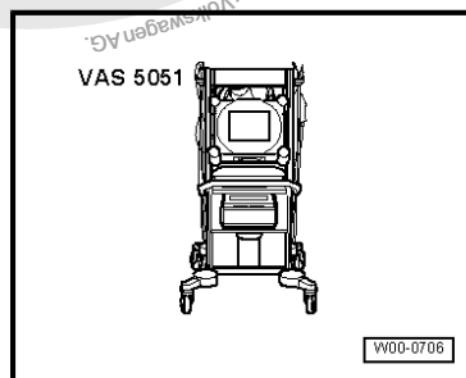
Control unit of Diesel direct injection system - J248-

- Install the connectors by pressing them to the side.
- Install the arms and wipers of the windscreen and the lower trim of the windscreen frame.
- Check coding used until now and codify the new Control unit of Diesel direct injection system - J248- [⇒ page 111](#) .

2.2 Event memory of Control unit of Diesel direct injection system - J248- - check and erase

Special tools and workshop equipment required

- ◆ Vehicle diagnostic and service information system - VAS 5051A/52-





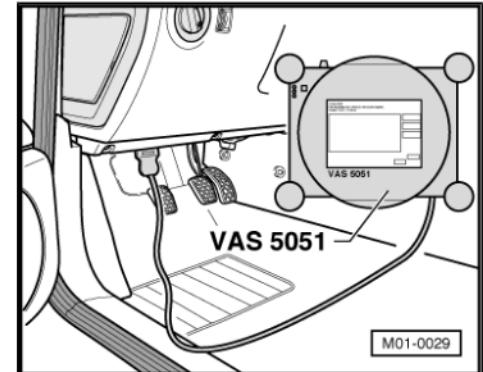
- ◆ Diagnosis cable - VAS 5051/1- or Diagnosis cable - VAS 5051/3-

2.2.1 Operation sequence

- Connect the Vehicle diagnostic, testing and information system - VAS 5051A/52- as follows:
- Insert the socket of Diagnostic cable - VAS 5051/1- or Diagnostic cable - VAS 5051/3- in the diagnostic connection.
- Start the engine and leave it at idling speed.

Only if the engine does not start:

- Turn on the ignition.



2.2.2 Select operating mode:

- On display, press the surface to "vehicle self-diagnosis".

2.2.3 Select the vehicle system:

- On the display, press key "01 - Engine electronics".

In the display is possible to check the Engine control unit - J623- identification and the code.

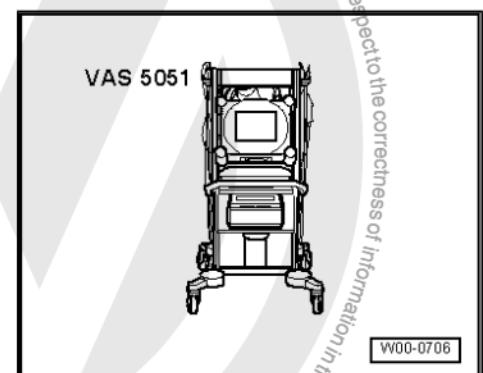
2.2.4 Select diagnosis function:

- On display, press the surface to "02 - select event memory".
- If no fault was saved in the Engine control unit - J623- , the display will show "0 faults identified".
- If faults were saved in the Engine control unit - J623- , these are shown, sequentially, on the display.
- Press ← key.
- On display, press the surface to "05 - erase event memory".
- Press function "06 end of session".

2.3 Functions and components - adapt

Special tools and workshop equipment required

- ◆ Vehicle diagnostic and service information system - VAS 5051A/52-



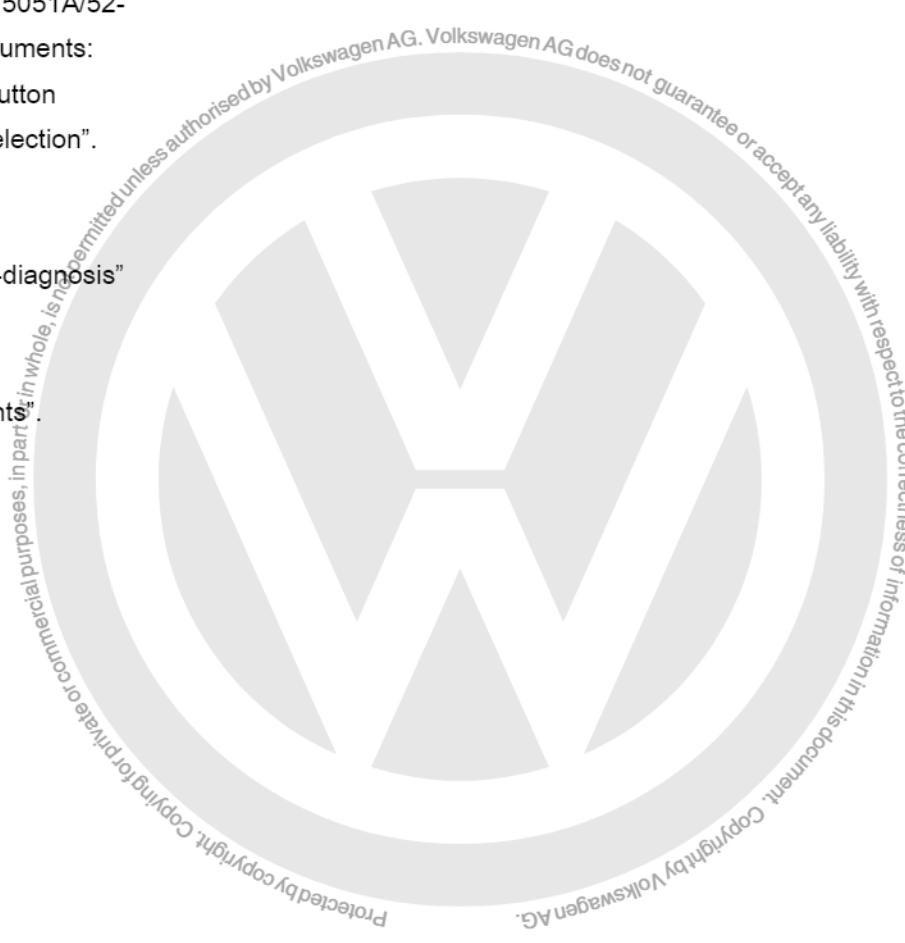
- ◆ Diagnosis cable - VAS 5051/1- or Diagnosis cable - VAS 5051/3-



Select the "fault location function" in the Vehicle diagnostic, test-
ing and information system - VAS 5051A/52-

After consulting all command instruments:

- Press the "Sprung" or "Jump"button
- Select "Function/component selection".
- "Select propeller"
- Select "Engine codes"
- Select " 01 - Systems with self-diagnosis"
- Select "Engine control".
- Select "Functions"
- Select "Functions or components".





26 – Exhaust system

1 Removing and installing exhaust system parts



Note

- ◆ After performing works on the exhaust system, make sure that the system is not tensioned and there is enough distance in relation to the body. If necessary, release the double clamp(s) and align silencer and exhaust tube so that there is enough space in relation to the body in the entire path, and the bearings/support straps are evenly used.
- ◆ Always replace self-locking nuts.



WARNING

Always replace self-locking nuts and screws subject to angular torque

1.1 Exhaust system - remove and install

Fox



1 - Gasket

- Replace.

2 - Exhaust manifold

- With exhaust gas return connection.

3 - Washer

4 - Self-locking nut

- 25 Nm
- Replace after each removal.
- Lubricate the thread with High temperature paste - G 052 112 A3- .

5 - Front exhaust tube with catalytic converter

6 - Supporting bearing

- Replace it if damaged.

7 - Support

8 - 23 Nm

9 - Double clamp

- Pay attention to the correct assembly position
[⇒ page 116](#)

10 - Self-locking nut

- 40 Nm
- Replace after each removal.

11 - Supporting bearing

- Pay attention to the correct assembly position
[⇒ page 116](#)
- Replace it if damaged.

12 - Separation point

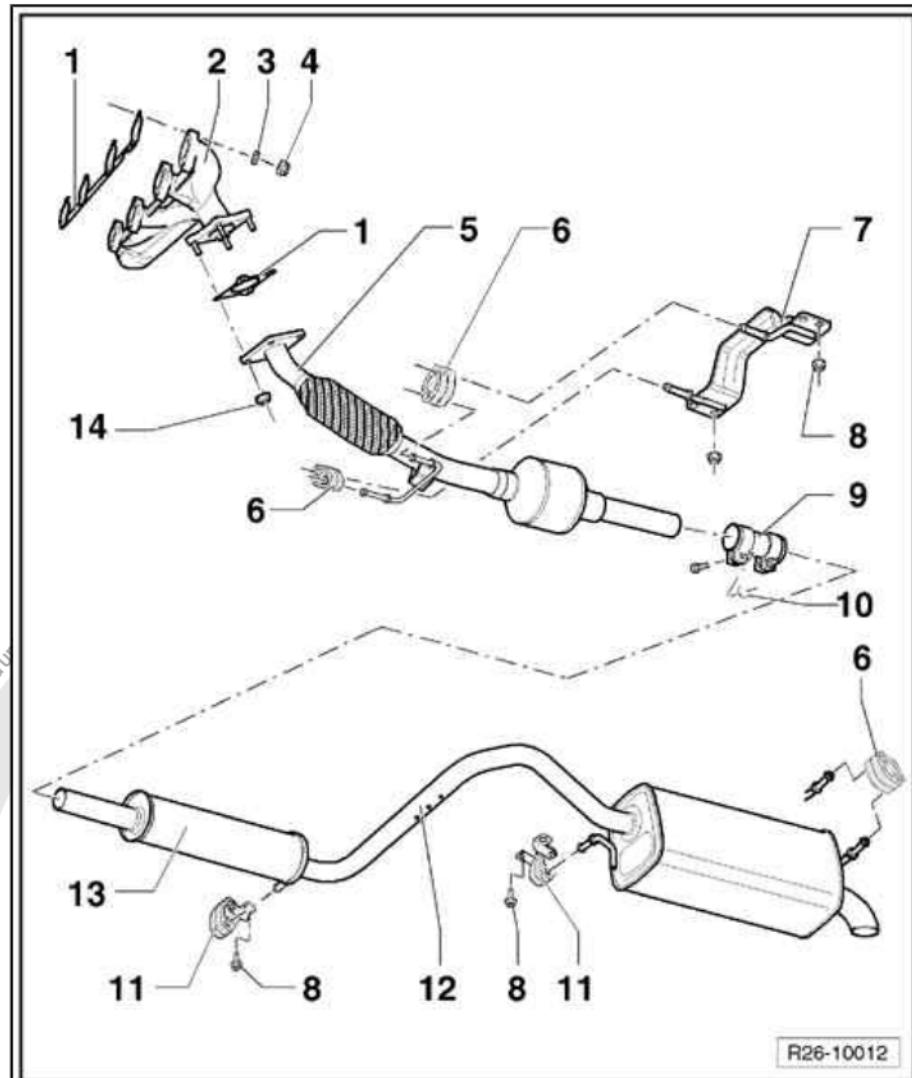
- For repair.
- Characterized through three prints onto the exhaust tube diameter.
- In serial production, the intermediate silencer and rear silencer are assembled as a single part. In the event of repairs, the intermediate silencer and the rear silencer are supplied separately with a double repair clamp for connection.
- Separate the exhaust tube in the separation location with a body repair saw, e.g. Pneumatic saw or EQ 7415 - VAG 1523A- or Tube cutter - VAS 6254- in a straight angle
[⇒ page 116](#)

13 - Intermediate muffler

- In case of repair, replace individually
[⇒ page 116](#)
- Pay attention to the correct assembly position
[⇒ page 116](#)

14 - Self-locking nut

- 40 Nm
- Replace after each removal.
- Lubricate the thread with High temperature paste - G 052 112 A3- .





1 - Gasket
 Replace.

2 - Exhaust manifold
 With exhaust gas return connection.

3 - Washer

4 - Self-locking nut
 25 Nm
 Replace after each removal.
 Lubricate the thread with High temperature paste - G 052 112 A3- .

5 - Front exhaust tube with cat-a-
 alytic converter

6 - Supporting bearing
 Replace it if damaged.

7 - Support

8 - 23 Nm

9 - Double clamp
 Pay attention to the correct assembly position [⇒ page 116](#)

10 - Self-locking nut
 40 Nm
 Replace after each removal.

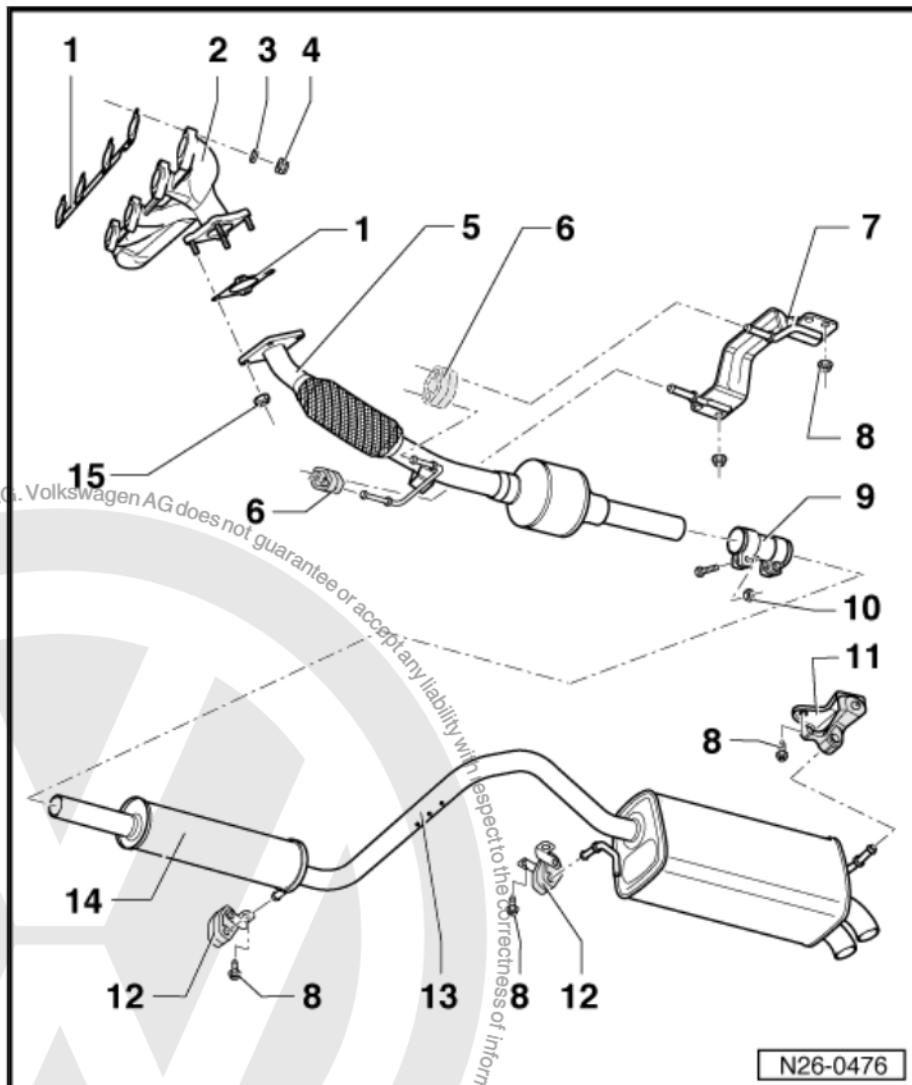
11 - Supporting bearing
 Replace it if damaged.

12 - Supporting bearing
 Pay attention to the correct assembly position [⇒ page 116](#)
 Replace it if damaged.

13 - Separation point
 For repair.
 Characterized through three prints onto the exhaust tube diameter.
 In serial production, the intermediate silencer and rear silencer are assembled as a single part. In the event of repairs, the intermediate silencer and the rear silencer are supplied separately with a double repair clamp for connection.
 Separate the exhaust tube in the separation location with a body repair saw, e.g. Pneumatic saw or EQ 7415 - VAG 1523A- or Tube cutter - VAS 6254- in a straight angle [⇒ page 116](#)

14 - Intermediate muffler
 In case of repair, replace individually [⇒ page 116](#)
 Pay attention to the correct assembly position [⇒ page 116](#)

15 - Self-locking nut
 40 Nm
 Replace after each removal.
 Lubricate the thread with High temperature paste - G 052 112 A3- .

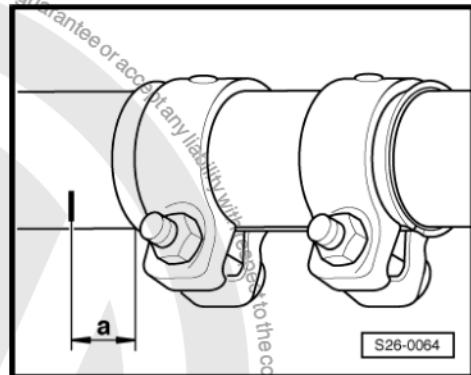


N26-0476



Installation position of double clamp

- Distance -a- between double clamp and marking should be approx. 5 mm.



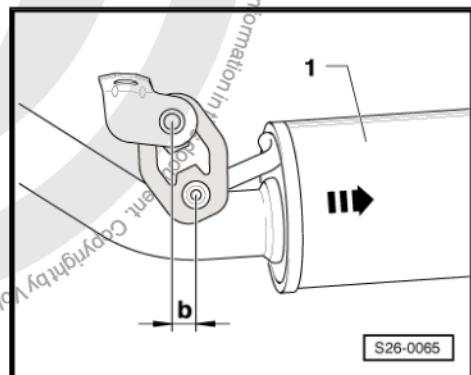
1.1.1 Prerequisites

- The exhaust system should be cold.

1.1.2 Operation sequence

Disposition of support installation

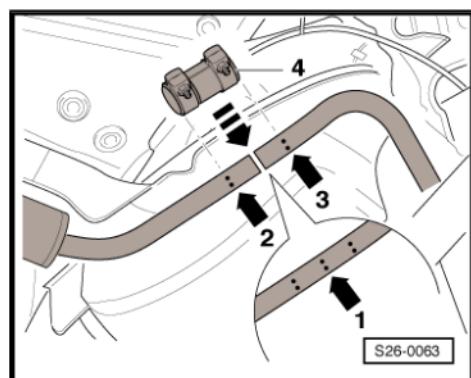
The -arrow- indicates the front of the vehicle.



1.1.3 Operation sequence

- Install the front silencer -1- so that measure -b- is between 3...7 mm.

Separation point on the exhaust tube



Special tools and workshop equipment required

- ◆ Pneumatic saw - VAG 1523A- or Tube cutter - VAS 6254-

1.1.4 Operation sequence

- Cut the tube perpendicularly on the marked point -seta- -1-.
- Position the double repair clamp -4- on the side markings -arrows 2 and 3-. Tightening torque 40 Nm [⇒ page 116](#)



2 Exhaust gas return system



Note

- ◆ The selection for the exhaust gas return system occurs through the Engine control unit - J623- with the exhaust gas return valve - N18- .
- ◆ The mechanical valve for the return of exhaust gases with the cone-shaped valve stem allows several transversal opening cuts in different valve strokes.
- ◆ A paced selection allows any positioning to the valve.
- ◆ Always replace self-locking nuts.

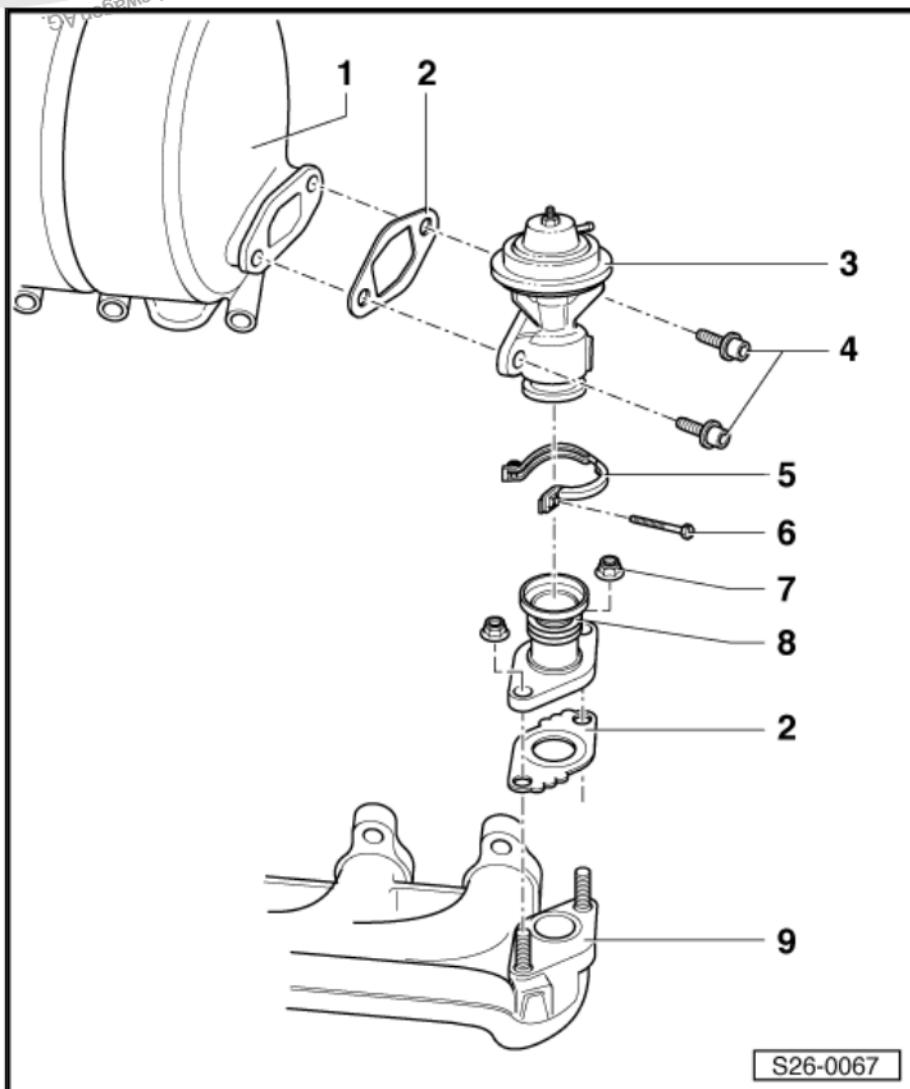


WARNING

Always replace self-locking nuts and screws subject to angular torque

2.1 Exhaust gas return system components - removal and installation

- 1 - Intake manifold
- 2 - Gasket
- 3 - Exhaust gas recirculation system
- 4 - 25 Nm
- 5 - Clamp
- 6 - 10 Nm
- 7 - Self-locking nut
- 8 - 20 Nm
- 9 - Replace after each removal.



S26-0067



8 - Connecting tube

9 - Exhaust manifold

2.2 Vacuum hose connection diagram

1 - Exhaust gas recirculation system

2 - Valve for recirculation of exhaust gases - N18-

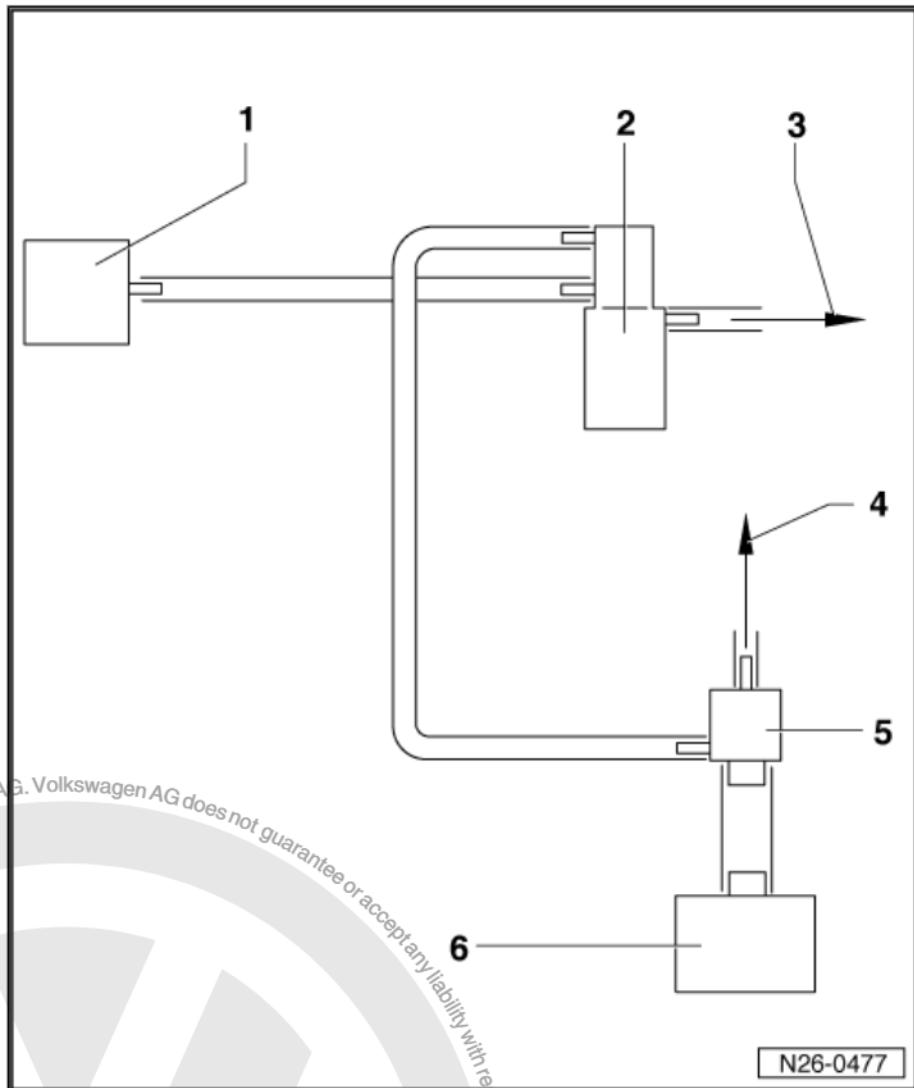
3 - Up to the air filter

4 - To brake servo.

5 - Check valve

Pay attention to the correct assembly position

6 - Vacuum pump

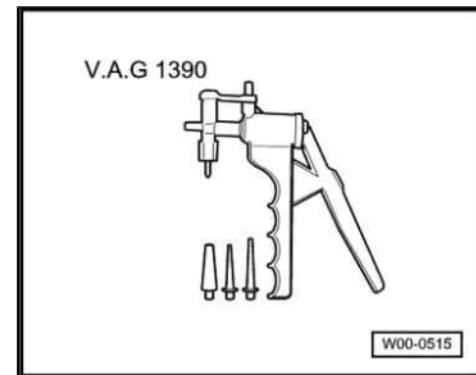


2.3 Check the exhaust gas return valve

Special tools and workshop equipment required

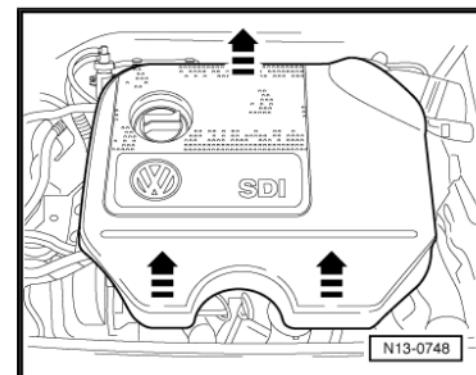


- ◆ Vacuum pump - VAG 1390 (VWB) - ou - VAS 6213-



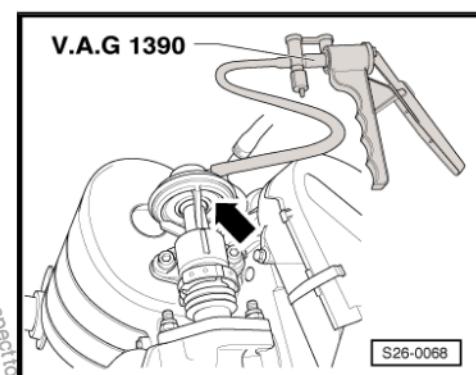
2.3.1 Checking sequence

- Remove the engine cover, -arrows-
- Disconnect the vacuum tube from the exhaust gas return valve - N18- .



- Connect Vacuum pump - VAG 1390 (VWB) - ou - VAS 6213- to the vacuum tube.
- Install vacuum pump - VAG 1390 (VWB) - ou - VAS 6213- . The membrane must move towards the vacuum connection (check direction from below).

Disconnect the vacuum pump hose from the exhaust gas return valve. The valve must close audibly. (The membrane moves towards the exhaust gas angle).



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28 – Ignition system

1 Preheating system - check

Special tools and workshop equipment required

- ◆ Portable multimeter - VAG 1526C-
- ◆ Auxiliary measuring cable set - VAG 1594C-

Checking conditions

- Blade fuse 178 for glow plugs on fuse support / Battery - A- in order.
- The Battery - A- voltage must be at least 11.5 V.
- All electrical equipment, such as lights and heated rear window, must be off.
- Engine control unit - J623- in order.

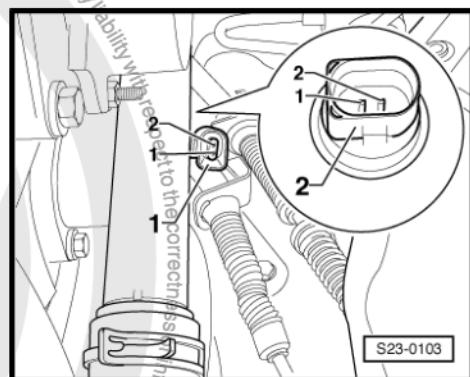
Checking sequence

- Disconnect the 2-pin connector -1- from the Coolant temperature sensor - G62- -2-.



Disconnecting the connector from Coolant temperature sensor - G62- simulates the situation "engine too cold", the pre-heating process is performed upon turning engine on.

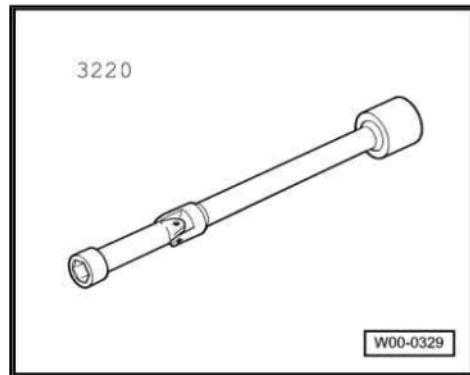
- Remove the connector of glow plugs
- Connect the multimeter to check voltage between one plug terminal and the vehicle earth.
- Turn ignition on for approx. 20 seconds to inform an approximate voltage value of the Battery - A- .
- If there is no voltage:
- Check the event memory, correct existing faults, if any, and erase the event memory **⇒ page 110** .



1.1 Glow plugs- check

Special tools and workshop equipment required

- ◆ U/J extension and socket, 10 mm - 3220-



- ◆ Auxiliary measuring cable set - VAG 1594C-
- ◆ Test probe - VAG 1527B-



1.1.1 Checking conditions

- Blade fuse 178 for glow plugs on fuse support / Battery - A- in order.
- The Battery - A- voltage must be at least 11.5 V.
- All electrical equipment, such as lights and heated rear window, must be off.

1.1.2 Checking sequence

- Disconnect the plug connector.
- Connect Test probe - VAG 1527B- with auxiliary measurement cables - VAG 1594C- to the positive pole (+) of Battery - A- .
- Fit the Test probe - VAG 1527B- in sequence one after another in each plug.

Lit LED: plug in order.

Non-lit LED: replace the plug.

- Remove and install all glow plugs with U/J extension and socket 10 mm - 3220- . Tightening torque: 15 Nm.

04.13

